3/84

145-S-574

INSTRUCTION MANUAL

MODEL 145-S-574
20 MHz FUNCTION/ PULSE GENERATOR

WAVETEK

WAVETEK SAN DIEGO, INC.

9045 Balboa Ave., San Diego, CA 92123

INSTRUCTION MANUAL

MODEL 145-S-574
20 MHz FUNCTION/
PULSE GENERATOR

The Model 145-S-574 is identical to the standard Model 145, except for the addition of an output protection circuit externally mounted to the FUNCTION OUT 50Ω connector. Data for this circuit is located immediately before the standard manual.

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SAFETY

This instrument is wired for earth grounding via the facility power wiring. Do not bypass earth grounding with two wire extension cords, plug adapters, etc.

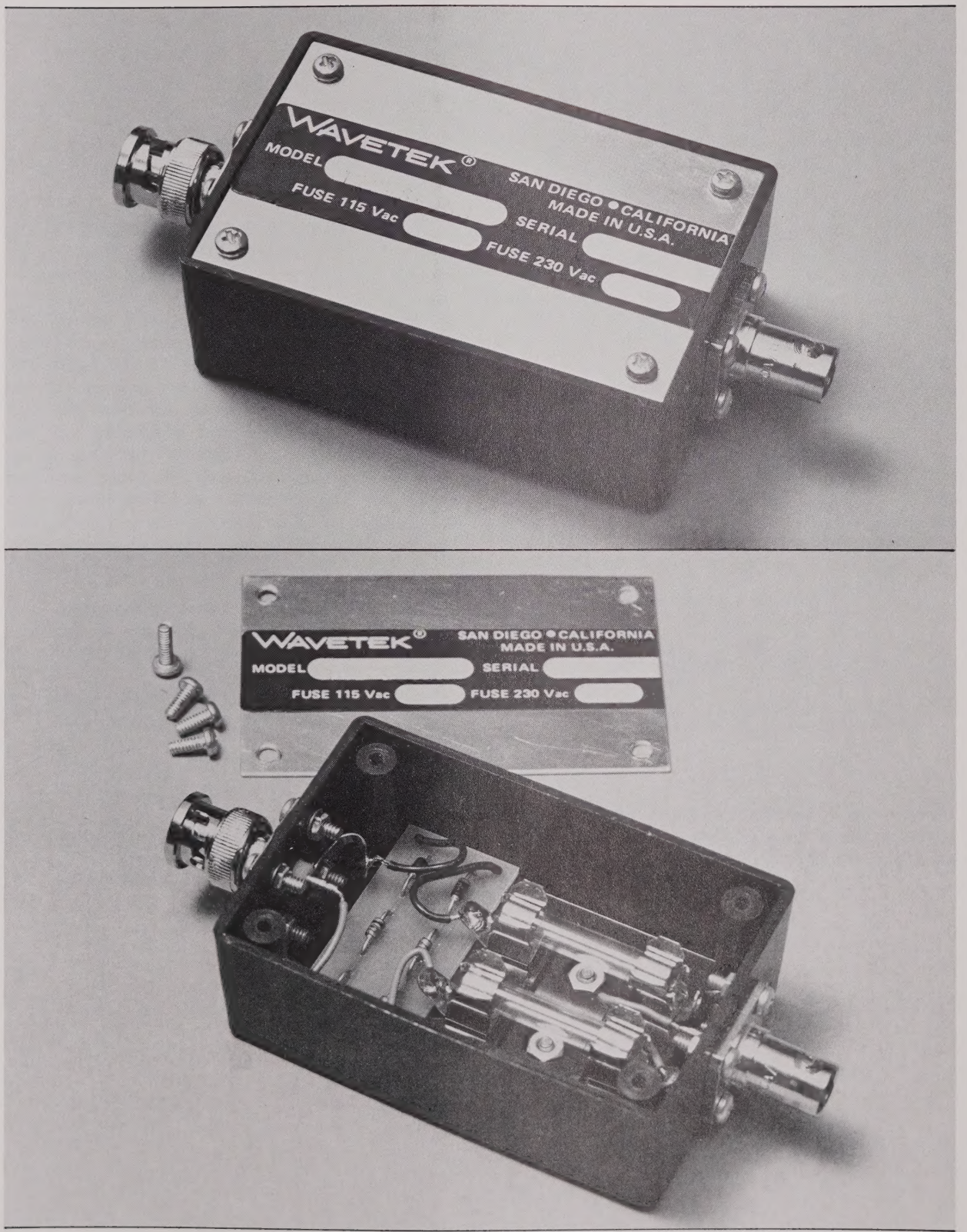
BEFORE PLUGGING IN the instrument, comply with installation instructions.

MAINTENANCE may require power on with the instrument covers removed. This should be done only by qualified personnel aware of the electrical hazards.

The instrument power receptacle is connected to the instrument safety earth terminal with a green/yellow wire. Do not alter this connection. (Reference: ⏚ or ⚠ stamped inside the rear panel near the safety earth terminal.)

WARNING notes call attention to possible injury or death hazards in subsequent operations.

CAUTION notes call attention to possible equipment damage in subsequent operations.



Model 145-S-574 Protection Circuit

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1 DESCRIPTION AND OPERATION OF THE MODEL 145-S-574 OVERLOAD PROTECTION CIRCUIT

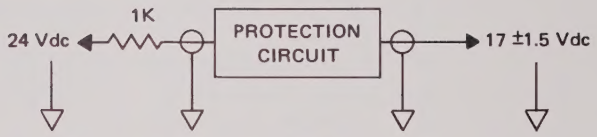
The overload protection circuit protects the Model 145 output circuit against some accidentally applied overloads (the output is not protected against low voltage or low current overloads). The circuit consists of fused ground and signal leads with diodes and zeners across the leads (see drawing 145-S-574). Sufficient voltage of either polarity applied at the OUTPUT BNC will be shorted by one of the two zener/diode paths before the voltage and current are felt by the Model 145 itself. If the applied current is sufficient, one or both fuses will blow, protecting the Model 145 from an overload. The zener voltage is sufficient to prevent the shorting of the Model 145's own output.

2 ACCEPTANCE TEST PROCEDURE FOR MODEL 145-S-574 OUTPUT PROTECTION CIRCUIT

1. Measure the impedance between the input ground and output ground. It should be ±1.5Ω.

2. Measure the impedance between the input and output terminals. It should be 6 ±1.5Ω.

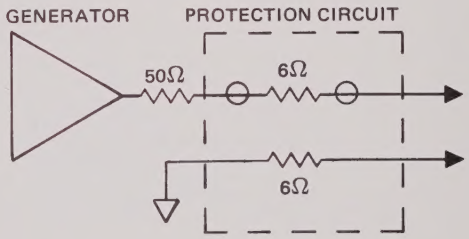
3. Connect the input to a +24 Vdc voltage source through a 1 kΩ resistor. Measure the output voltage. It should be +17 ±1.5 Vdc.



4. Same as step 3, except using −24 Vdc as the voltage source and output should be −17 ±1.5 Vdc.

3 PERFORMANCE OF THE MODEL 145 AND THE MODEL 145-S-574

When the protection circuit is used, the output impedance is increased from 50 to 62Ω; see the following figure.



Therefore, output amplitude is reduced by approximately 12% if a 50Ω load is used. Other specifications remain the same. The performance of the Model 145 is as specified in this manual.

PARTS LIST FOR OUTPUT PROTECTION CIRCUIT 145-S-574

Part		Manufacturer	Part No.	Qty
1.	Case and Cover	Calectro	H4-723	1
2.	BNC Connector, UG1104A/U	Pamona	2447	1
3.	BNC Connector, UG209A/U	Pamona	2451	1
4.	Fuse Holder	Littelfuse	357002	1
5.	Diode, Zener	Coml	1N4738	4
6.	Diode	Semtec	SCE-1 or 1N4002	2
7.	Fuse, 3AG, 250V, 0.175A	Littelfuse	312.175	2
8.	Label	Wavetek	1400-00-5790	1
9.	PC Board	Wavetek	130-115	1
10.	Screw, 4-40 X 3/8, PH	Coml		10
11.	Locking Terminal Lug	H. H. Smith	1410-4	2
12.	Lockwasher, Intl Tooth, #4	Coml		10
13.	Nut, #4 Std	Coml		2
14.	Nut, #4 Radio	Coml		6
15.	Screw, 4-40 X 3/8, PH, Self-tapping	Coml		4

RECOMMENDED SPARES

Recommended parts for two years:

Item	Qty
7	8

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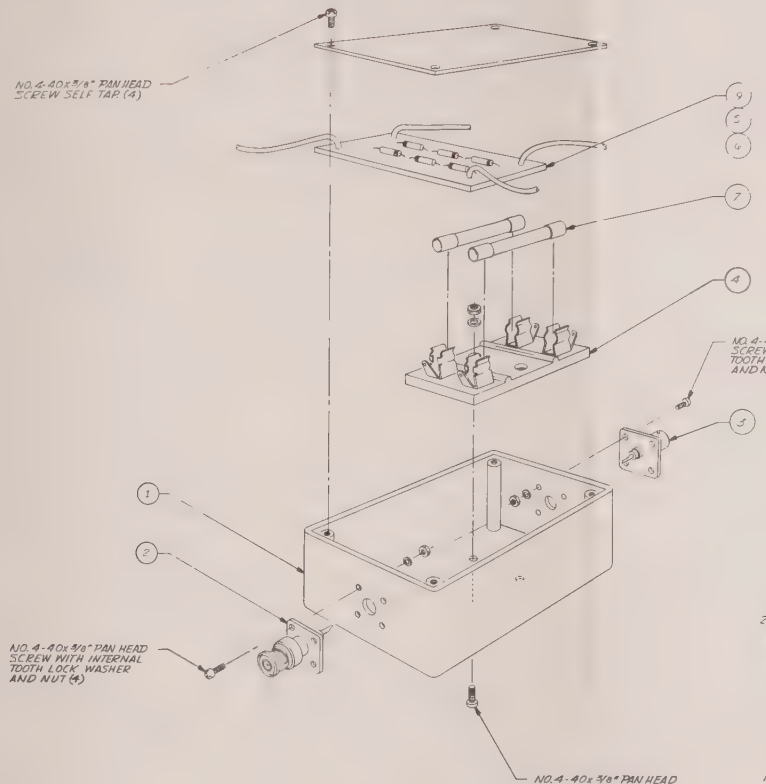
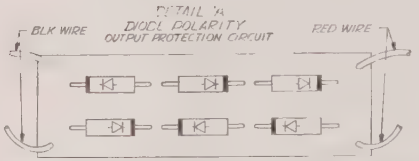
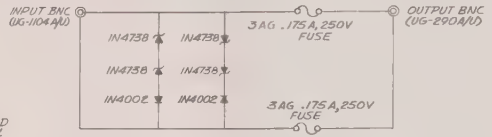
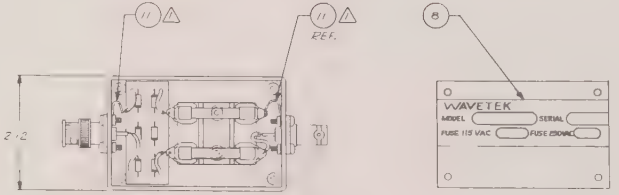
REV	ECN	BY	DATE	APP


NO.4-40 X 3/8" PAN HEAD SCREW SELF TAP. (4)
SEE DETAIL "A"
9
5
6
7
4
NO.4-40 X 3/8" PAN HEAD SCREW WITH INTERNAL TOOTH LOCK WASHER AND NUT (4)
3
1
2
NO.4-40 X 3/8" PAN HEAD SCREW WITH INTERNAL TOOTH LOCK WASHER AND NUT (4)
NO.4-40 X 3/8" PAN HEAD SCREW WITH INTERNAL TOOTH LOCK WASHER AND STD. 4-40 NUT (2)

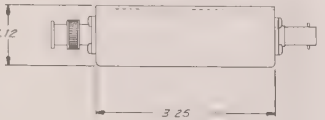




SCHEMATIC
OUTPUT PROTECTION
CIRCUIT



OUTLINE DWG. SHOWN WITH COVER
REMOVED FOR CLARITY



△ LOCKING TERMINAL LUG IS INSTALLED ON THE BOTTOM MOUNTING SCREW OF EACH TERMINAL STRIP AS SHOWN.

NOTE UNLESS OTHERWISE SPECIFIED

REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN D. COOPER	DATE 2-10-76	WAVETEK SAN DIEGO, CALIFORNIA
MATERIAL	PROJ ENGR		TITLE OUTPUT PROTECTION CIRCUIT
	RELEASE APPROV		
FINISH WAVETEK PROCESS	TOLERANCE UNLESS OTHERWISE SPECIFIED XXX ± .010 XX ± .030 ANGLES ± 1°		
	DO NOT SCALE DWG		MODEL NO
	SCALE		DWG NO 0002-00-0136 REV
			CODE IDENT 23338 SHEET 1 OF 1

SECTION 1
GENERAL DESCRIPTION

1.1 THE MODEL 145

The Model 145 20 MHz Pulse/Function Generator has the versatility of output found in a function generator, plus the pulse characteristics of a pulse generator. It is a precision source of sine, triangle, balanced square, positive square and negative square waveforms, a source of dc levels and a source of normal and inverted pulses. All are front panel and remote control variable from 0.0001 Hz to 20 MHz (periods from 50 ns to 10,000s). Pulse widths are variable from 25 ns to 1 ms and pulse delays variable from 50 ns to 10 ms. Double pulses (two pulses per period) are also available with variable time between pulses. The logical complement of the pulse is selectable and either pulse or complement are output simultaneously as ECL, $\overline{\text{ECL}}$, TTL, $\overline{\text{TTL}}$ and variable amplitude and offset pulses.

The amplitude controllable output of either waveform or pulse can be varied to 30 volts peak-to-peak (open circuit) and attenuated up to 80 dB. DC voltage or dc offset of signal is variable by front panel control and by external control between ±15 volts (open circuit). The outputs are also triggerable for one or multiple cycles by front panel switch or remote signal. A voltage representing generator frequency and a TTL level sync pulse at the frequency of the generator are auxiliary outputs.

1.2 SPECIFICATIONS

1.2.1 Versatility

Instrument operates as either a function generator or pulse generator.

1.2.2 Function Generator

Waveforms
Selectable sine ∿ , square ⊓ , triangle ∧ , positive square ⊓ , negative square ⊔ and dc. TTL sync pulse and fixed amplitude pulses of TTL, $\overline{\text{TTL}}$, ECL and $\overline{\text{ECL}}$, all simulaneously available with function output.

Operational Modes
Continuous: Generator oscillates continuously at selected frequency.

Triggered: Generator is quiescent until triggered by an external signal or manual triger, then generates one cycle at selected frequency.

Gated: As triggered mode, except generator oscillates for the duration of the gate signal.

Frequency Range
0.0001 Hz to 20 MHz in 10 overlapping ranges with approximately 1% vernier control.

Function Output
∿ , ⊓ , ∧ selectable and variable to 30 Vp-p (15 Vp-p into 50Ω). ⎍ , ⊔ , to 15 Vp (7.5 Vp into 50Ω). All waveforms and dc can supply 150 mA peak current and may be attenuated to 60 dB in 20 dB steps with an additional 20 dB vernier.

DC Output and DC Offset
Selectable thru FUNCTION OUT output. Controlled by front panel control or by applying an external voltage. Adjustable between a minumum of ±14.4 Vdc (±7.2 Vdc into 50Ω) with signal peak plus offset limited to ±14.4 Vdc (±7.2 Vdc into 50Ω). External offset sensitivity approximately −1 V/V with output into open circuit. DC offset and output waveform attenuated proportionately the 60 dB output attenuator.

Sync Output
A TTL level pulse. Will drive 50Ω termination.

GCV—Generator Controlled Voltage
At GCV OUT connector, a 0 to +2V signal proportional to generator frequency. 600Ω source impedance.

VCG—Voltage Controlled Generator
Up to 1000:1 frequency change with external 0 to 2 volt signal to VCG IN connector. Upper and lower frequencies limited to maximum and minimum of selected range.

Slew Rate: 2% of range per μs.

Linearity:
±0.2% for 10 Hz to 200 kHz.
±0.75% for 0.001 Hz to 2 MHz.

Impedance: 2 kΩ.

Trigger and Gate
Input Range: 1 Vp-p to ±10V.

Impedance: 10 kΩ, 33 pF.
Pulse Width: 25 ns minimum.
Repetition Rate: 10 MHz maximum.
Adjustable Triggered Signal Start/Stop Point (sine and triangle only): Approximately -90° to $+90^\circ$ to 2 MHz.

1.2.3 Frequency Precision

Dial Accuracy
±3% of full range from X .01 Hz to X 1 MHz.
±5% of full range on X 10 MHz.

Time Symmetry
Square wave variation less than:
±1% from 0.001 Hz to 200 kHz
±0.5% from 20 Hz to 20 kHz

1.2.4 Amplitude Precision

Amplitude Change With Frequency
Sine variation less than:
±0.1 dB for 0.001 Hz to 200 kHz
±0.5 dB for 200 kHz to 2 MHz
±3.0 dB for 2 to 20 MHz

Step Attenuator Accuracy
0.3 dB per 20 dB step at 2 kHz.

1.2.5 Waveform Characteristics

Sine Distortion
< 0.5% on X 100 Hz to X 10 kHz.
< 1.0% on X .01 to X 10 Hz and X 100 kHz.
All harmonics 34 dB below fundamental on X 1 MHz.
All harmonics 26 dB below fundamental on X 10 MHz.

Square Wave Rise/Fall Times
At FUNCTION OUT < 20 ns for 15V p-p output into 50Ω load.

1.2.6 Pulse Generator

Pulse Outputs
Variable amplitude pulse, and simultaneous fixed ECL, $\overline{\text{ECL}}$, TTL and $\overline{\text{TTL}}$ pulses and TTL sync pulse. All outputs can drive 50Ω terminations.

Operational Modes
Continuous, triggered and gated plus the following.
Normal Pulse: Adjustable width pulse in phase with sync signal.
Delayed Pulse: Pulse delayed with respect to normal pulse. Pulse delay and pulse width adjustable.
Double Pulse: Two pulses for every period. Time between pulses and pulse width adjustable. Minimum period 100 ns.

Pulse Period Range
50 ns to 10,000s in 10 overlapping ranges with approximately 1% vernier control.

Pulse Width
25 ns to 1 ms in 5 overlapping ranges with vernier control. Includes OFF and square wave.

Pulse Delay
50 ns to 10 ms in 6 overlapping ranges with vernier control.

Duty Cycle
Duty cycles to 70% for periods > 100 ns (< 10 MHz); for periods < 100 ns (> 10 MHz) duty cycles are approximately 50%.

Function Output
Variable to 30V p-p (15V p-p into 50Ω). DC offset and attenuation are same as for function generator.

Pulse Rise/Fall Times
At FUNCTION OUT, < 20 ns for 15V p-p output into 50Ω load.

1.2.7 General

Stability
Short Term: ±0.05% for 10 minutes.
Long Term: ±0.25% for 24 hours.
Percentages apply to amplitude, frequency and dc offset.

Environmental
Specifications apply at 23°C ± 5°C. Instrument will operate from 0°C to 50°C ambient temperatures.

Dimensions
28.6 cm (11¼ in.) wide; 13.3 cm (5¼ in.) high; 27.3 cm (10¾ in.) deep.

Weight
5 kg (11 lb) net; 6.6 kg (14½ lb) shipping.

Power
90 to 105V, 108 to 126V, 198 to 231V and 216 to 252V selectable; 48 to 400 Hz; less than 30 watts.

NOTE

All specifications apply from 0.1 to 2.0 on frequency dial when FUNCTION OUT output is at maximum and 50Ω terminated. Function generator specifications apply when PULSE WIDTH control is OFF.

1.2.8 OPTION 001

Option 001 is a rear panel mounted elapsed operating timer. The indicator cell is an electromechanical device (containing no mercury) capable of indicating 5000 hours of operating time. The indicator cell is mounted on the rear panel in a cell holder and wired between −15Vdc and circuit common. The indicator cell meets MIL-I-81219(WP) and is QPL listed (QPL-81219-2). The holder meets MIL-87219A(AS) and MS-90373WP-4.

1.3 EQUIPMENT REQUIRED

Equipment required is given in table 1-1.

Table 1-1. Equipment Required But Not Supplied

Equipment	Manufacturer's Part Number	Alternate Part Number	Application Acceptance	Application Calibration
Oscilloscope	TEK 465	TEK 475	X	X
Voltmeter	Fluke 8000A	Fluke 8010A		X
Distortion Analyzer	HP334A			X
Counter	HP5300B	HP5345A		X
Function Generator	Wavetek 180	Wavetek 148	X	X
DC Voltage Source	JF 332		X	X
50Ω Termination	TEK 011-0099-00	Fluke Y9103		X
3 Foot Coax Cables	TEK 012-0057-01	Pomona 4964-SS-36	X	X
Coax Tee Connector	TEK 103-0030-00	Pomona 3285	X	

SECTION 2
INSTALLATION

2.1 MECHANICAL INSTALLATION

After unpacking the instrument, visually inspect all external parts for possible damage to connectors, surface areas, etc. If damage is discovered, file a claim with the carrier who transported the unit. The shipping container and packing material should be saved in case reshipment is required.

2.2 ELECTRICAL INSTALLATION

2.2.1 Power Connection

WARNING

To preclude injury or death due to shock, the third wire earth ground must be continuous to the facility power outlet. Before connecting to the facility power outlet, examine extension cords, autotransformers, etc., between the instrument and the facility power outlet for a continuous earth ground path. The earth ground path can be identified at the plug on the instrument power cord; of the three terminals, the earth ground terminal is the nonmatching shape, usually cylindrical.

CAUTION

To prevent damage to the instrument, check for proper match of line and instrument voltage and proper fuse type and rating.

NOTE

Unless otherwise specified at the time of purchase, this instrument was shipped from the factory with the power transformer connected for operation on a 108 to 132 Vac line supply and with a 0.5 amp slow blow fuse.

Conversion to other input voltages requires a change in rear panel fuse-holder voltage card position and slow blow fuse according to the following table and procedure.

Card Position	Input Vac	Fuse
100	90 to 105	0.5 amp
120	108 to 126	0.5 amp
220	198 to 231	0.25 amp
240	216 to 252	0.25 amp

1. Open fuse holder cover door and rotate fuse pull to left to remove the fuse.
2. Select operating voltage by orienting the printed circuit board to position the desired voltage on the top left side. Push the board firmly into its module slot.
3. Rotate the fuse-pull back into the normal position and insert the correct fuse into the fuse holder. Close the cover door.
4. Connect the ac line cord to the mating connector at the rear of the unit and the power source.

2.2.2 Signal Connections

Use 3 foot RG58U 50Ω shielded cables equipped with female BNC connectors to distribute all input and output signals.

2.3 ELECTRICAL ACCEPTANCE CHECK

This checkout procedure is a general verification of generator operation. Should a malfunction be found, refer to the warranty in the front of this manual.

Refer to table 1-1 for equipment required for this procedure.

Preset the generator front panel controls as follows:

Set up the oscilloscope, Model 145 and external generator as shown in figure 2-1.

Control	Position
Dial	1.0
GENERATOR MODE	CONT
TRIGGER LEVEL	9 o'clock
PULSE DELAY	1 μs ▮ 10 μs
PULSE DELAY VARIABLE	12 o'clock
NORMAL/DOUBLE/DELAYED	NORMAL
PULSE WIDTH	OFF
PULSE WIDTH VARIABLE	12 o'clock
ATTENUATION	0
ATTENUATION VERNIER	Full cw
FUNCTION	⊓⊔
DC OFFSET	OFF
TRIGGER START/STOP	0° CAL
FREQ/PERIOD MULT	1K
VERNIER	Full cw

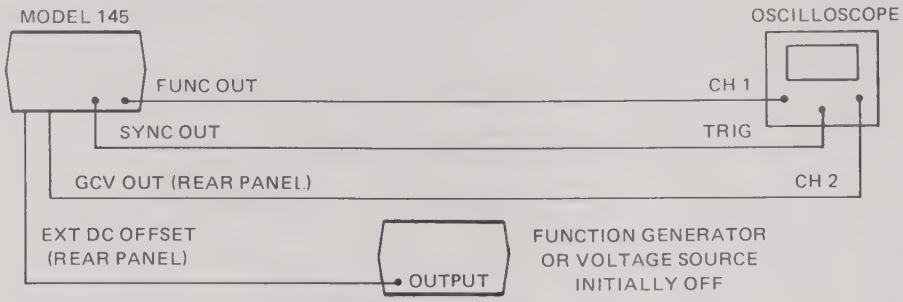


Figure 2-1. Initial Setup

Table 2-1. Acceptance Procedure

Step	Control	Position/Operation	Observe
1	POWER	ON	1 kHz square wave.
2	Dial	Rotate dial. Return to 1.0.	Rotation ccw increases frequency of square on one channel and dc level on other channel; cw decreases frequency and dc level.
3	FREQ/PERIOD MULT	Rotate switch. Return to 1K.	Rotation cw increases frequency; ccw decreases frequency (dc level not affected).
4	VERNIER	Rotate ccw. Return to CAL.	Rotation ccw gives a small decrease in frequency.
5	ATTENUATION	Rotate ccw. Return to 0.	Rotation ccw reduces square wave amplitude.
6	ATTENUATION VERNIER	Rotate ccw.	Square wave amplitude decreases.
7	DC OFFSET	Rotate cw. Return to OFF.	Square wave is immediately offset below previous level; then waveform moves up to a positive level. OFF returns waveform to original position. (Clipping occurs at ±15V.)
8	Function Generator or Voltage Source	Vary input voltage.	Waveform dc level varies.
	Remove EXT DC OFFSET IN cable and connect to VCG IN connector. Remove GCV OUT cable.		
9	Function Generator or Voltage Source	Vary input voltage; then disconnect input.	Frequency increases with increased voltage, decreases with decreased voltage.
10	ATTENUATION VERNIER	Rotate cw.	– – –
11	FUNCTION	Rotate to DC, ∿, ∿, ⊓, ⊓, ⊔, then ∿.	Note dc level on scope. ∿, ∿ and ⊓ should be centered on dc level. ⊓ should rest on dc level, ⊔ should rise to dc level.
12	GENERATOR MODE	GATE	A dc level.
13	MANUAL TRIG	Press down.	A series of sine waves.

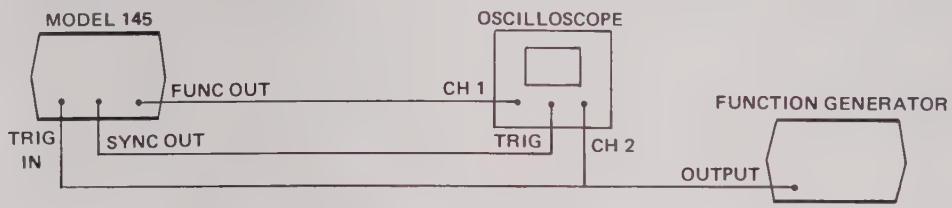


Figure 2-2. Second Setup

Table 2-1. Acceptance Procedure (Continued)

Step	Control	Position/Operation	Observe
	Set up a trigger source as shown in figure 2-2. Trigger on triangle waveform. Set trigger source at 100 Hz ∿ .		
14	TRIGGER LEVEL	Rotate knob. Set for several cycles.	Knob varies number of cycles gated.
15	GENERATOR MODE	TRIG	One cycle per trigger cycle.
16	TRIGGER START/STOP	Rotate knob, then to 0° CAL.	CW starts sine wave at +90°; ccw starts sine wave at –90°. Fully cw gives continuous sine waves.
	NOTE: Select square wave on trigger source.		
17	FUNCTION	PULSE	– – –
18	PULSE WIDTH	Turn cw to 100 μs ▮ 1 ms.	Pulse appears.
19	PULSE WIDTH VARIABLE	Rotate, then to 12 o'clock	CW increases pulse width; ccw decreases pulse width.
20	FUNCTION	PULSE, then $\overline{\text{PULSE}}$.	Pulse direction reverses; dc levels remain the same values.
21	NORMAL/DOUBLE/ DELAYED Switch	DELAYED	– – –
22	PULSE DELAYED	100 μs ▮ 1 ms	– – –
23	PULSE DELAYED VARIABLE	Turn knob.	Pulse moves horizontally.
24	NORMAL/DOUBLE/ DELAYED Switch	DOUBLE	– – –
25	PULSE DELAYED VARIABLE	Turn knob to resolve two pulses.	– – –

2.4 PREPARATION FOR SHIPMENT

If original packing material was saved, pack instrument in same manner as received. When using packing materials other than original, use the following guidelines:

1. Wrap instrument in plastic packing material.
2. Use double-wall cardboard shipping container.
3. Protect all sides with shock-absorbing material such as styrofoam dunnage to prevent instrument movement within the container.
4. Seal shipping container with approved sealing tape.
5. Mark FRAGILE on all sides, top and bottom of shipping container.

2.5 PREPARATION FOR STORAGE

This instrument should be stored in a clean, dry environment. The following limitations apply to both storage and reshipment.

1. Temperature within −55°C to +75°C range.
2. Relativity humidity not to exceed 95% at +25°C and sea level (non-condensing).
3. Altitude from sea level to 40,000 feet.

2.6 PREPARATION FOR EXTENDED STORAGE

For extended storage greater than 6 months, pack instrument as indicated for shipment.

SECTION 3
OPERATION

3.1 CONTROLS AND CONNECTIONS

The generator front panel controls and connectors are shown in figure 3-1 and keyed to the following descriptions.

(1) POWER Switch

Turns generator on and off.

(2) Frequency Dial

Settings under the dial index mark multiplied by (17) determine the output signal frequency. The dial calibration marks correspond to the frequency (black) numbers only. The period (grey) numbers are approximations only. Refer to table 3-1 for quick period/frequency conversion. The frequency can be varied by the vernier (17) and the VCG signal (16) .

(3) GENERATOR MODE Switch

Selects one of the following three modes.

CONT – Continuous output at FUNCTION OUT, SYNC OUT and, if PULSE WIDTH is on, PULSE OUT connectors.

TRIG – DC level output at all six output connectors until the generator is triggered by MANUAL TRIGGER switch or with a signal at the TRIG IN connector. When triggered, the generator output is one cycle of waveform or one pulse period followed by a dc level.

GATE – As for TRIG except the output is continuous for the duration of the trigger signal at TRIG IN. The last cycle or period started is completed.

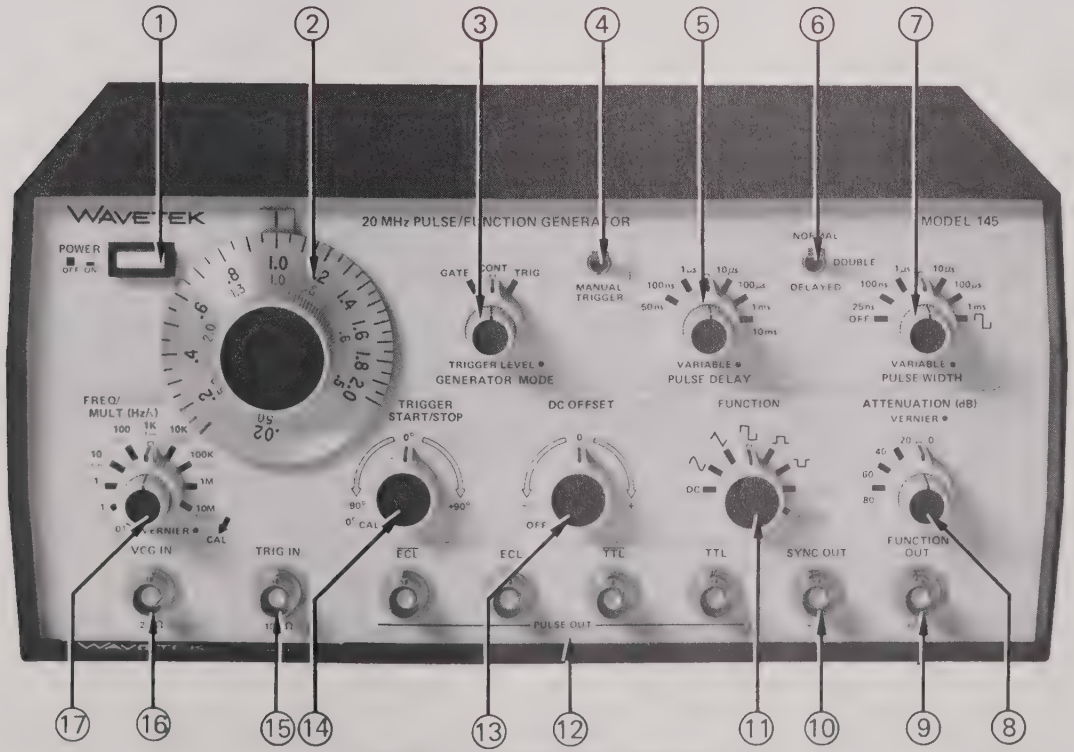


Figure 3-1. Controls and Connectors

Table 3-1. Period to Frequency Conversion

Converted Frequency Dial Values
(Based on f = 1/T where ⊓⊔)
⊢T⊣

Time	Freq	Time	Freq	Time	Freq
.5	2	2.3	.44	4.1	.24
.6	1.67	2.4	.42	4.2	.24
.7	1.43	2.5	.4	4.3	.23
.8	1.25	2.6	.39	4.4	.23
.9	1.11	2.7	.37	4.5	.22
1	1	2.8	.36	4.6	.22
1.1	.91	2.9	.35	4.7	.21
1.2	.83	3	.33	4.8	.21
1.3	.77	3.1	.32	4.9	.2
1.4	.71	3.2	.31	5	.2
1.5	.67	3.3	.3		
1.6	.63	3.4	.29		
1.7	.59	3.5	.29		
1.8	.56	3.6	.28		
1.9	.53	3.7	.27		
2	.5	3.8	.26		
2.1	.48	3.9	.26		
2.2	.46	4	.25		

Symbols

M = 10^6
k = 10^3
m = 10^{-3}
μ = 10^{-6}
n = 10^{-9}

To use the dial calibration marks when setting period time, the period must be converted to frequency.

Example: Set generator for a 23 μs pulse period.

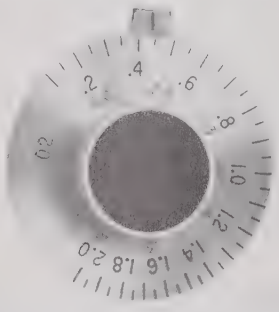
1. Find the number 23 (or .23, 2.3, etc.) in the Time column. Note its form and Freq equivalent.

Time	Freq
2.3	.44

2. Express 23 μs using the 2.3 form: 2.3 X 10^{-5}.

3. Set FREQ/PERIOD MULT switch to the equivalent of 10^{-5} : 10μ.

4. Set the dial to the frequency equivalent of 2.3: .44.



NOTE: Refer to paragraph 1.2 for dial accuracy.

TRIGGER LEVEL Control

Determines the level at which the input trigger signal at the TRIG IN connector (15) is accepted as a trigger or gate in the trigger and gate modes. The trigger level can be varied from fully cw, where a positive-going excursion thru approximately −10V is a trigger, to fully ccw, where a positive-going excursion thru approximately +10V level is a trigger.

(4) **MANUAL TRIGGER Switch**

Triggers or gates the output signal when GENERATOR MODE switch (3) is at TRIG or GATE. In trigger mode, one cycle is output when the switch is pressed. In gate mode, cycles are continuously output as long as the switch is held down.

NOTE
Set TRIGGER LEVEL (3) fully ccw.

(5) **PULSE DELAY Control**

When NORMAL/DOUBLE/DELAYED switch (6) is at DELAYED, PULSE DELAY selects one of six time ranges for delay of pulse with respect to the undelayed signal leading edge. When (6) is at DOUBLE, PULSE DELAY selects the time between double pulse leading edges.

VARIABLE Control

Inner knob selects delay time within the range selected by the outer knob.

(6) **NORMAL/DOUBLE/DELAYED Switch**

Selects the pulse parameters as follows:

NORMAL – Pulse of width and frequency set by front panel switches appears at TTL, $\overline{\text{TTL}}$, ECL,

$\overline{\text{ECL}}$ and FUNCTION OUT connectors with synchronous leading edges to the sync pulse (10) trailing edge.

DOUBLE—As NORMAL plus an additional pulse in each pulse period delayed from the first pulse leading edge by time (5) .

DELAYED—As NORMAL, except the pulse leading edge is delayed from the normal pulse leading edge by time (5) .

(7) PULSE WIDTH Control

Outer knob selects the range for the width of all pulses except sync. Has OFF and square wave detents. When in OFF position, the 145 has no PULSE OUT outputs. The square wave (⊓) detent is normally used to check the 50% period point; PULSE DELAY (5) has no effect. For the best square wave output, set FUNCTION (11) to ⊓ .

VARIABLE Control

Inner knob selects pulse width within the range selected by the outer knob.

(8) ATTENUATION Control

Outer knob reduces output voltage level of all outputs at FUNCTION OUT with increasing steps of attenuation.

VERNIER Control

Inner knob is a 20 dB vernier which controls the output within the steps of the outer knob. DC and offset voltages are not affected by this control.

(9) FUNCTION OUT Connector

The only output for the functions other than fixed amplitude pulse. At this output the functions and pulses are controllable in amplitude and dc offset; the other outputs furnish fixed amplitude pulses only.

(10) SYNC OUT Connector

Furnishes a TTL pulse for each cycle or period of the generator. To be used for scope or similar synchronization. Refer to paragraph 3.2.1.4 for conversion to an ECL sync pulse.

(11) FUNCTION Switch

Selects one of eight output signals; dc, waveforms or pulses.

(12) PULSE OUT

Four standard pulses for logic circuits as follows (PULSE WIDTH (7) must be other than OFF):

TTL Connector—Furnishes a transistor-transistor-logic level pulse whose occurence and duration are controllable. Levels are typically <0.5V quiescent, >2.0V active into a 50Ω termination.

$\overline{\text{TTL}}$ Connector—Same as TTL connector except active and quiescent levels are reversed.

ECL Connector—Furnishes an emitter-coupled logic level pusle with controllable occurence and duration. Levels are typically -1.8V quiescent, -0.9V active into a 50Ω termination connector to -2 volts. Refer to paragraph 3.2.1.3 for ECL loading instructions.

$\overline{\text{ECL}}$ Connector—Furnishes an output like the ECL output, except active and quiescent levels are reversed.

(13) DC OFFSET Control

Offsets the waveform or dc level at (9) from approximately -15V to $+15$V (open circuit; approximately ± 7.5V into 50Ω). An OFF position ensures no offset.

(14) TRIGGER START/STOP Control

Sets the start and stop point of the selected waveform (sine or triangle only) appearing at (9) Usually used in the trigger mode and in combination with (13) to create desired waveforms. 0° CAL position ensures conventional waveforms symmetrical about 0 Vdc.

(15) TRIG IN Connector

Accepts a 1 Vp-p to 10V external signal to trigger the generator. (Up to ± 50V will not damage circuitry.) Triggers on rising edge of input which crosses TRIGGER LEVEL (3) setting from negative to positive.

(16) VCG IN Connector

Accepts 0 to $+2$V ac or dc voltages to vary up to 1000:1 the frequency and period of the outputs.

The upper and lower limits are defined by the maximum and minimum dial (2) settings multiplied by (17) . VCG input will not drive the generator beyond the normal dial limits of a range.

(17) FREQ/PERIOD MULT Switch

The outer knob selects one of ten frequency/period multipliers for the dial (2) setting. Frequency, then period, are noted at each setting.

VERNIER Control

A fine adjustment of the frequency dial (2) setting.

Not Shown **EXT DC OFFSET IN Connector (Rear Panel)**

Applied voltage offsets the selected waveform linearly. Offset is 1V for each −1V applied with output connected into an open circuit. Maximum input is ±7.5V. Offset is affected by the attenuator (8) .

Not Shown **GCV OUT Connector (Rear Panel)**

This connector gives a 0 to +2V signal proportional to the frequency of the generator within any given range. The signal can be used as the X drive for X-Y recorders.

3.2 OPERATION

Perform the initial checkout in Section 2 for the feel of the instrument. Any questions concerning individual controls and connectors may be answered in paragraph 3.1.

3.2.1 Signal Termination

3.2.1.1 FUNCTION OUT Signal

Proper signal termination, or loading, of the generator connectors is necessary for its specified operation. For example, the proper termination of the main output is shown in figure 3-2. Placing the 50Ω terminator, or 50Ω resistance, in parallel with a higher impedance matches the receiving instrument input impedance to the generator output impedance, thereby minimizing signal reflection or power loss on the line due to phase angle mismatch.

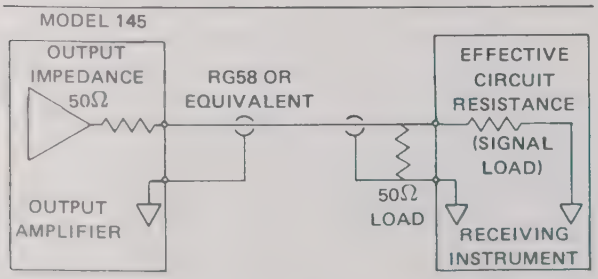


Figure 3-2. Signal Termination

3.2.1.2 TTL PULSE OUT Signals

The TTL and $\overline{\text{TTL}}$ PULSE OUT outputs can drive 50Ω and higher impedance terminations.

3.2.1.3 ECL PULSE OUT Signals

The ECL and $\overline{\text{ECL}}$ PULSE OUT outputs are driven by MC10124's. The signals must be properly terminated at the point that they enter an external ECL circuit. Several connection possibilities are shown in figure 3-3.

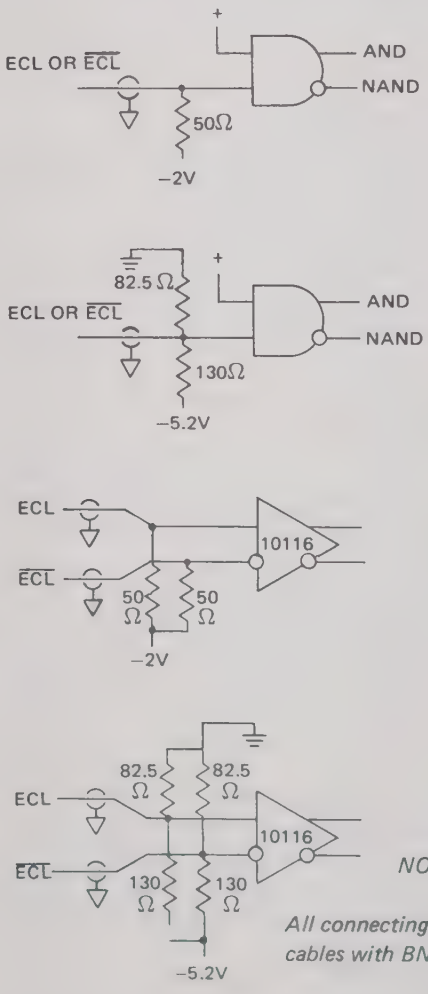


Figure 3-3. ECL Terminations

3.2.1.4 Conversion of SYNC OUT TTL to ECL

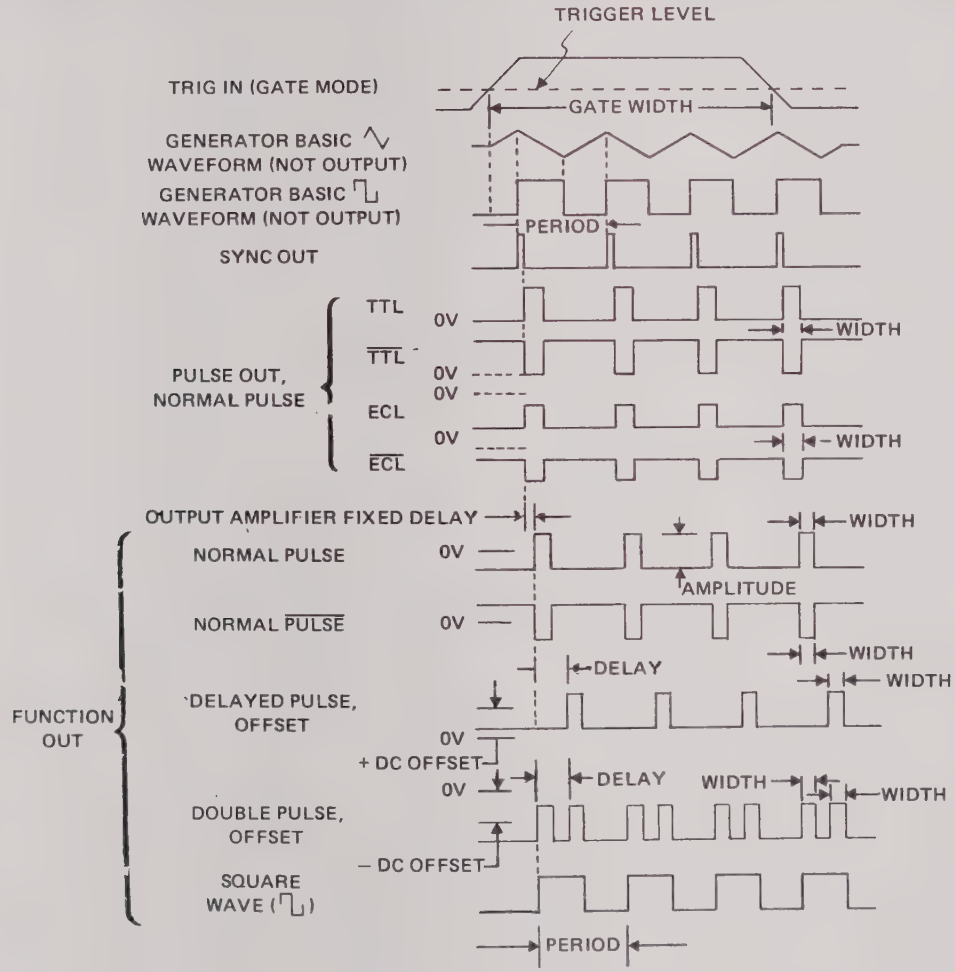
The SYNC OUT TTL pulse can be converted to an ECL pulse by rerouting two jumpers on the trigger/pulse printed circuit board. Disconnect jumper at E24 and connect to E25. Disconnect jumper at E27 and connect to E28. The two jumpers are correctly routed from E25 to E26 and from E28 to E29 for ECL operation. Instrument disassembly is covered in paragraph 5.3.

3.2.2 Pulses

See figure 3-4 for definition of controllable pulse characteristics.

3.2.3 Waveforms

See figure 3-5 for definition of controllable waveform characteristics.



NOTES

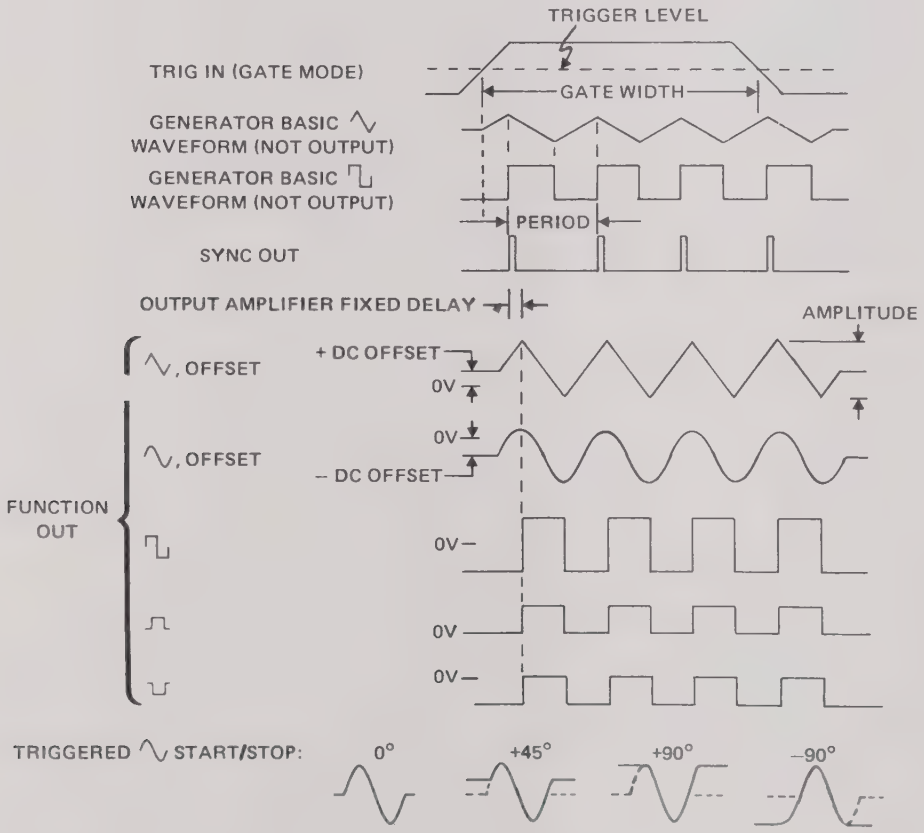
1. *Not Shown: TTL, $\overline{TTL}$, ECL, $\overline{ECL}$ double pulse, delayed pulse and $\overline{pulse}$.*
2. *Pulse period is determined by the generator frequency setting unless in trigger mode, in which case it is determined by trigger frequency.*
3. *In trigger mode, just one period is generated for each trigger pulse.*
4. *DC offset plus pulse peak voltage > | 7.5V | causes pulse clipping.*

Figure 3-4. Pulse Characteristics

3.2.4 Voltage Controlled Function Generator Operation

Operation as a voltage controlled function generator (VCG) is as for a manually controlled function generator, only the frequency within particular ranges is additionally controlled with dc levels (±2V excursions) injected at the VCG IN connector. Set the frequency dial to a reference from which the frequency is to be voltage controlled.

1. For frequency control with positive dc inputs at VCG IN, set the dial for a lower frequency limit.
2. For frequency control with negative dc inputs at VCG IN, set the dial for an upper frequency limit.
3. For modulation with an ac input at VCG IN, set dial at desired center frequency. Do not exceed the maximum dial range of the selected frequency range.



NOTES

1. *Period is controlled by the generator frequency setting.*
2. *In trigger mode, just one period is generated for each trigger pulse.*
3. *DC offset plus peak waveform voltage > | 7.5V | causes waveform clipping.*

Figure 3-5. Waveform Characteristics

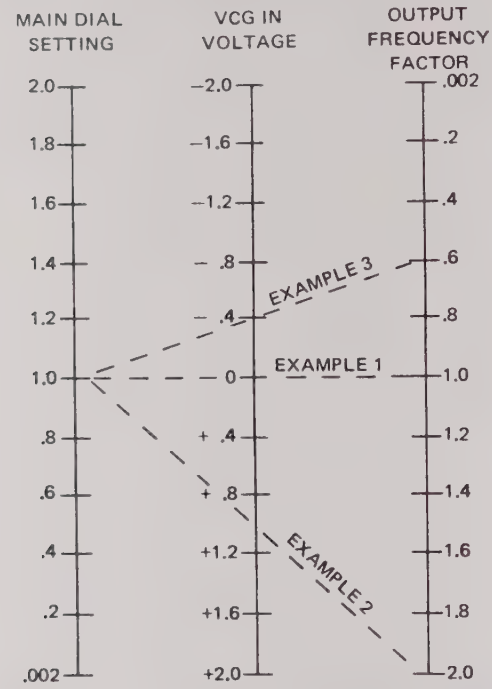


Figure 3-6. VCG Voltage-to-Frequency Nomograph

Figure 3-6 is a nomograph with examples of dial and voltage effects. Example 1 shows that with 0V VCG input, frequency is as determined by the main dial setting, 1.0 in this example. Example 2 shows that with a positive VCG input, output frequency is increased. Example 3 shows that with a negative VCG input, output frequency is decreased. (Note that the Output Frequency Factor column value must be multiplied by a frequency range multiplier to give the actual output frequency.)

NOTE

The frequency vernier must be rotated fully ccw for 1000:1 range.

Nonlinear operation results when the VCG input voltage is excessive; that is, when the attempted generator frequency exceeds the range setting (2 times the multiplier setting) or in the other direction, 1/1000th of the range setting.

The up to 1000:1 VCG sweep of the generator frequencies available in each range results from a 2V excursion at the VCG IN connector. With the frequency dial set to 2.0, excursions between −2V and 0V at VCG IN provide the up to 1000:1 frequency sweep. With the dial set to .002, excursions between 0V and +2V at VCG IN provide the up to 1000:1 sweep within the set frequency range.

3.2.5 Delay of Triggered Pulse

Additional pulse delay is available in triggered mode. Not only is the PULSE DELAY usable, but the ¼ cycle delay between trigger acceptance and sync pulse shown in figure 3-7 can also be variable delay.

Merely determine the delay desired and apply this formula for the frequency setting:

$$\text{Frequency in Hz} = \frac{1}{(4 \cdot \text{delay in seconds})}$$

Then, adjust the pulse width for your desired pulse. Practical range with the frequency dial and multiplier is 1 ms to 42 minutes. Delay control range is 50 ns to 10 ms.

Frequency vernier and start/stop control also affect the delay. So, for accurate frequency dial control of delay, set these at their cal positions.

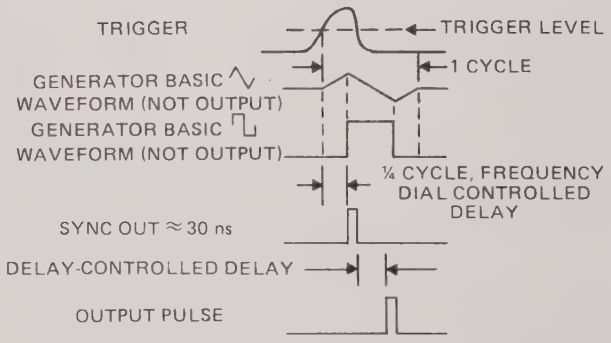


Figure 3-7. Pulse Delay From Trigger

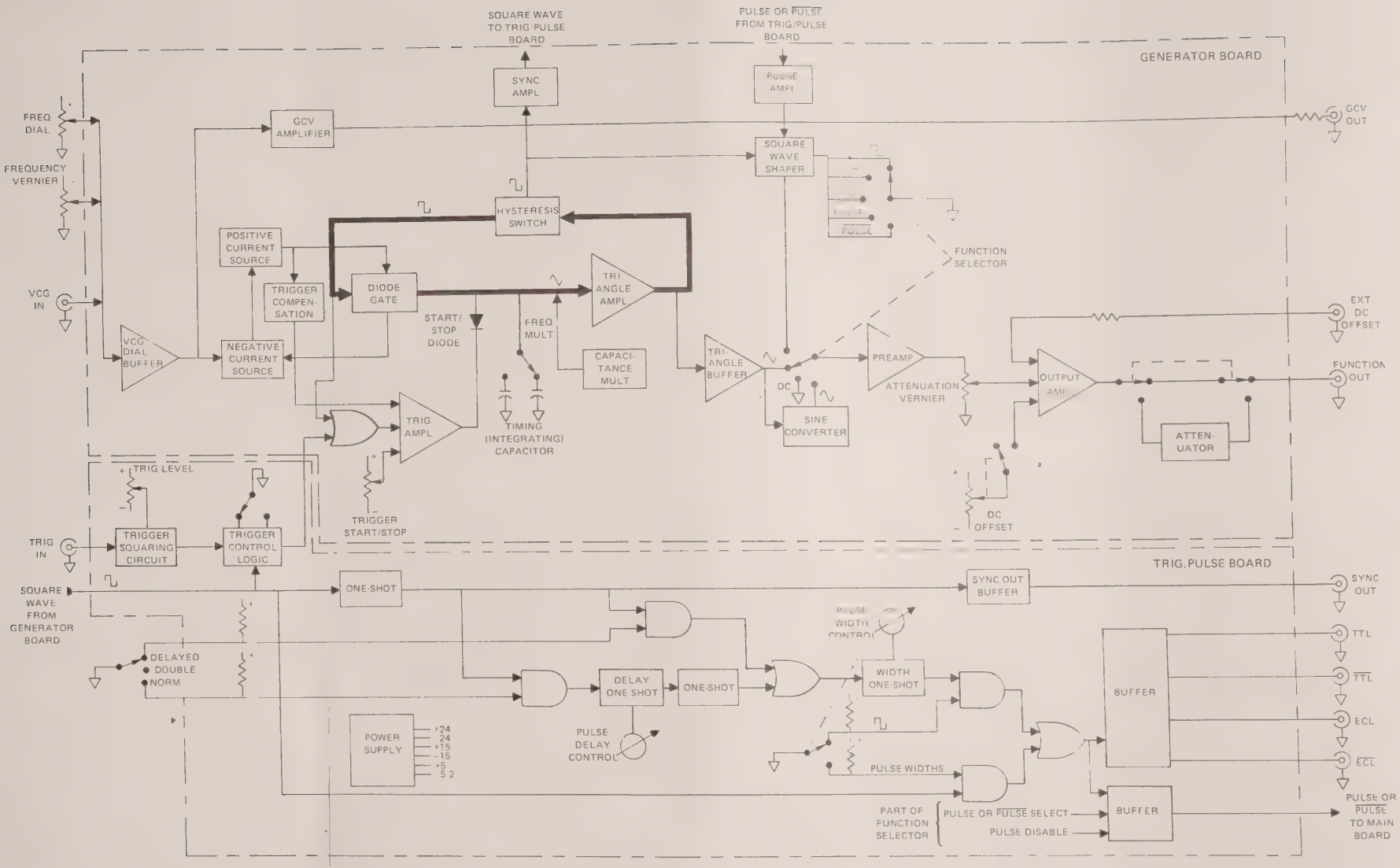


Figure 4-1. Overall Block Diagram

SECTION 4
CIRCUIT DESCRIPTION

4.1 BASIC WAVEFORM DEVELOPMENT

The heart of the generator (the bold path in figure 4-1) is a triangle and square wave generator. The triangle waves are developed by capacitor charging ramps that are alternately reversed in polarity. The polarity reversal is caused by a flip-flop circuit, or hysteresis switch, that in turn produces the square waves. The flip-flop changes states upon detecting amplitude limits of the charging ramps through the triangle amplifier.

As shown in figure 4-1, the VCG dial buffer sums the currents from the frequency dial, frequency vernier and VCG in connector. The VCG dial buffer is an inverting amplifier whose output voltage is used to control a positive current source and a negative current source. For symmetrical output waveforms, the currents from the two current sources are equal and directly proportional to the voltage of the VCG dial buffer output. The diode gate, which is controlled by the hysteresis switch, is used to switch the positive or the negative current to the integrating capacitor selected by the frequency multiplier. If the positive current is switched into the integrating capacitor, the voltage across the capacitor will rise linearly to generate the triangle rise transition. If the current is negative, the voltage across the integrating capacitor will fall linearly to produce the fall transition.

The triangle amplifier is a unity gain amplifier whose output is fed to the hysteresis switch. The hysteresis switch has two voltage limit points (+1.25 and −1.25V) at its input.

During the time the output voltage of the triangle amplifier is rising, the output voltage of the hysteresis switch is positive, but when the output voltage of the triangle reaches +1.25V, it triggers the hysteresis switch causing the output to switch negative. Once the control voltage into the diode gate becomes negative, it will switch the positive current out and switch the negative current in to the integrating capacitor, so that the voltage across the capacitor will reverse, starting a linear decrease of the waveform. When the decreasing voltage reaches −1.25V, the output of the hysteresis switch will switch back to positive, reversing the process. This action generates the triangle waveform as shown in figure 4-2. Since the output of the hysteresis switch is a square wave, the result is simultaneous generation of a square wave and a triangle wave at the same frequency.

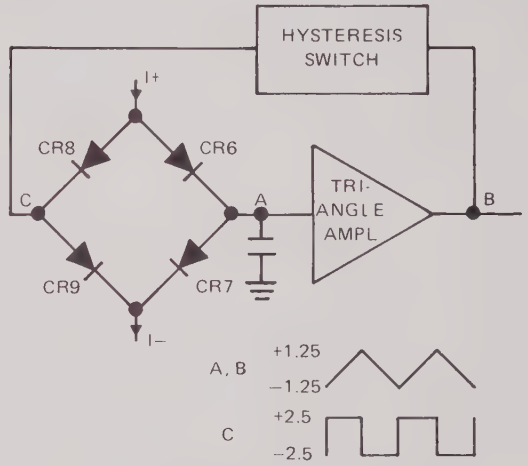


Figure 4-2. Basic Generator and Timing Diagram

The output frequency is determined by the magnitude of the capacitor selected by the frequency multiplier and the magnitude of the positive and negative current sources. Since the current sources are linearly proportional to the control voltage of the VCG circuit, the output frequency will also be linearly proportional to the control voltage.

The output of the hysteresis switch is fed to the sync amplifier and also the square wave shaper. The square wave shaper consists of a shaping circuit which limits the square wave output swing to ±1.25V. For positive pulse outputs, it limits the output voltage swing from −1.25 to 0V; and for negative pulse outputs, it limits the output swing from 0 to +1.25V. The PULSE or $\overline{\text{PULSE}}$ from the auxiliary board are bipolar and processed as the square wave.

The triangle wave from the triangle amplifier is coupled through a buffer amplifier and made available to the function selector switch. The buffer amplifier provides a low impedance to drive the sine converter circuit. The sine converter, using the nonlinear characteristics of its diodes, converts the triangle wave into a sine wave.

The square wave from the sync amplifier, processed through a one-shot and the sync out buffer, is externally available at the sync out connector. The sync pulse, then, is a TTL level pulse output of the generator frequency.

4.2 AMPLITUDE OFFSET AND ATTENUATION

The selected waveform is inverted and amplified in the preamplifier. The preamplified waveform is sent to the output amplifier.

The output amplifier is an inverting amplifier with a current limiting output stage for short circuit protection. The dc offset control provides the offset to the selected waveforms center reference. The dc offset can be set by voltage at the external dc offset connector. The output amplifier establishes the generator 0 dB attenuation reference. An output attenuator decreases this reference amplitude in operator selected 20 dB steps. The attenuator consists of three voltage dividers. Attenuation between the steps is provided by the attenuation vernier.

4.3 TRIGGER AND GATE CONTROL

Generator operation is controlled by allowing or preventing the timing capacitor to charge. Figure 4-3 shows in detail this portion of the circuit. For continuous operation, the trigger amplifier maintains a positive level above the positive peak developed by the charging capacitors. This reverse biases (turns off) the start/stop diode, and the trigger amplifier does not interfere with continuous operation.

When the trigger amplifier outputs some level below the positive peak charging level, the diode is forward biased (turned on) to sink the integrating current from the current source, preventing the capacitors from charging to the positive peak. This stops waveform generation and holds the triangle output at some dc level called the trigger baseline. The trigger baseline is the level where a triangle waveform cycle starts and where it stops. This baseline is directly applicable to the triangle waveform and thus affects the sine wave. The square wave levels, output via the hysteresis switch, are not affected by the triangle baseline levels.

The normal trigger baseline is zero volts, analogous to 0° phase of a sine or triangle waveform. The trigger start/stop control offsets the trigger amplifier output and can change the baseline for starting and stopping a sine or triangle waveform from its negative peak (−90°) to its positive peak (+90°) range. At the extreme positive peak level setting though, the diode is again reverse biased and generator operation goes continuous.

When charging level is being held, the positive current generator still varies its output with corresponding frequency control inputs. These varying currents must be sunk through the diode to keep the timing capacitors from varying their charge, and thus varying the trigger baseline. The baseline compensation circuit monitors the output from the positive current generator to control the trigger amplifier and thus control the necessary compensating current through the diode.

The trigger control logic determines that after a waveform starts, it always stops at a complete cycle and at the same phase at which it started. The trigger control logic latches the trigger amplifier for an enabling output from the time the cycle starts to when the negative peak of the last cycle is reached (just one cycle in the trigger mode). Upon reaching the negative peak, the timing capacitor continues charging positive again, but stops upon reaching the trigger baseline. A square wave from the hysteresis switch synchronizes the last negative peak time for unlatching the trigger amplifier for its trigger baseline output.

The generator mode control circuitry (not shown) determines whether the trigger control logic is to be fired for just one cycle, or is to be held on for the duration of the trigger input. When in gate mode, the trigger is directly coupled for controlling the trigger control logic. In the trigger mode, the squaring circuit output is converted by a one-shot to a narrow pulse which fires the trigger control logic.

The squaring circuit is a level detector that generates a square pulse for the duration of a trigger signal above the set trigger level. The pulse is also generated for the duration the manual trigger switch is held down in gate mode, and fires one cycle in triggered mode.

4.4 PULSE OUTPUTS

The pulse outputs are based on the square wave from the basic generator circuit (see figure 4-1); the pulse frequency is controlled by the frequency dial, frequency vernier and VCG voltage in the same manner as the waveforms. The square wave is first modified to the sync pulse by a one-shot circuit; then the normal/double/delayed pulse selector switch sets or inhibits AND gates to distribute the sync pulse to the delay one-shot and the width one-shot circuits. When the switch is in normal position, the sync pulse is gated to the width one-shot; the delay one-shot is bypassed. When the switch is in delayed position, the sync pulse is gated to the delay one-shot only. With the switch in the double position, the sync pulse is gated to both the delay and width one-shots.

Pulse width of the width and delay one-shot pulses can be varied by the front panel width and delay controls, respectively. The resulting pulse is gated by the selection of a pulse width value rather than the square wave (⊓⊔) detent on the pulse width switch. The pulse or the basic generator square wave, as selected by the pulse width control, is sent to a buffer circuit and output as TTL, $\overline{\text{TTL}}$, ECL and $\overline{\text{ECL}}$ pulses. The pulse or square wave is also routed to another buffer which is set by the selection of PULSE, $\overline{\text{PULSE}}$ or a

waveform with the front panel function switch. This output, a normal pulse or a complemented pulse, is routed to the square wave shaper and output, if selected, through the output amplifier as a variable amplitude pulse. The pulse modes of normal, delayed and double are shown as timing diagrams in figures 4-4, 4-5 and 4-6.

4.5 WIDTH AND DELAY ONE-SHOTS

The pulse width and delay one-shots feature front panel adjustable current sources to regulate the capacitor charge time and as a result, the one-shot pulse width. The steady state condition of the one-shot circuit is as shown in figure 4-7: Upon triggering, $\overline{Q}$ goes low, the switch transistor switches off and the capacitor begins to charge. When the voltage across the capacitor is sufficient, the level detector senses the set level, the flip-flop is cleared and the circuit reverts to its steady state condition. The duty cycle of the one-shots is limited by the capacitor discharge time when returning to steady state conditions.

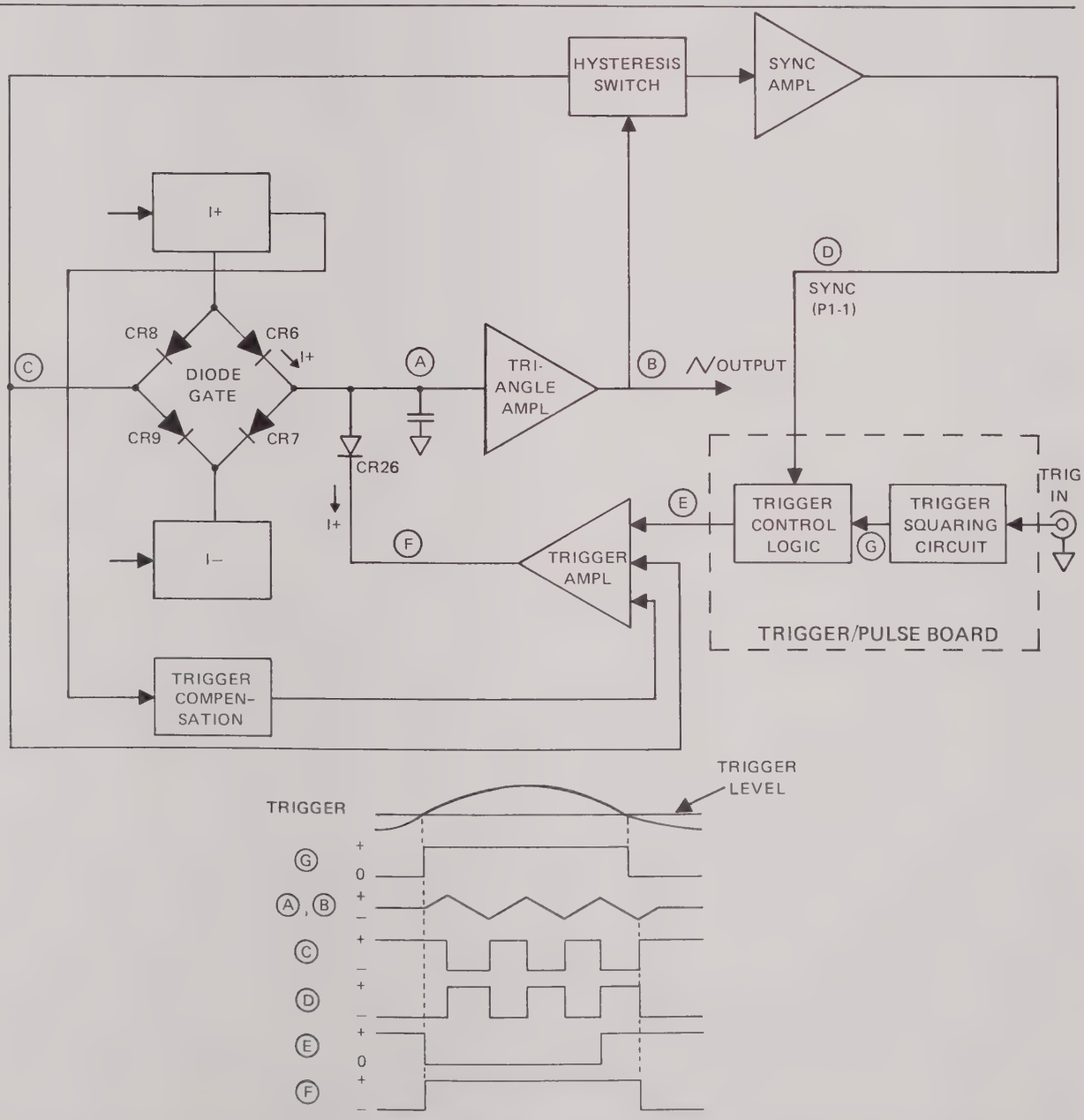


Figure 4-3. Trigger Circuit and Timing

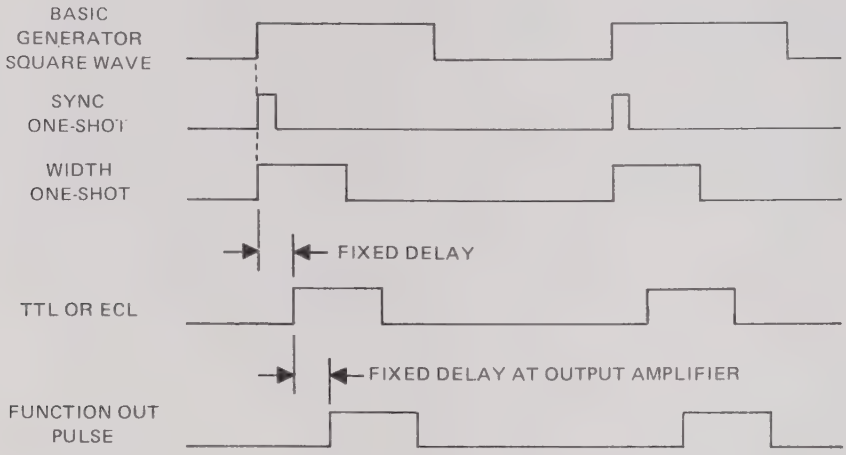


Figure 4-4. Normal Mode Timing

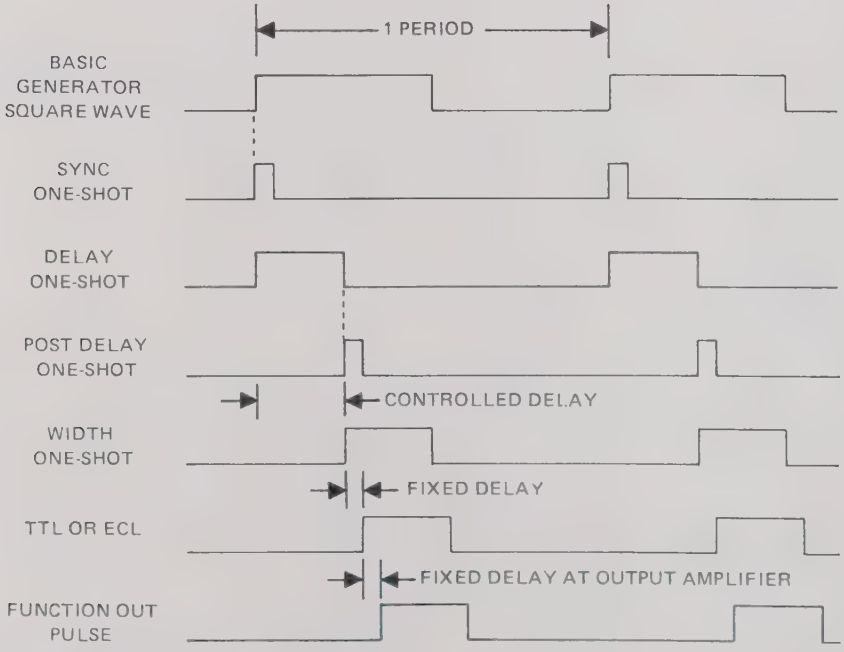


Figure 4-5. Delayed Mode Timing

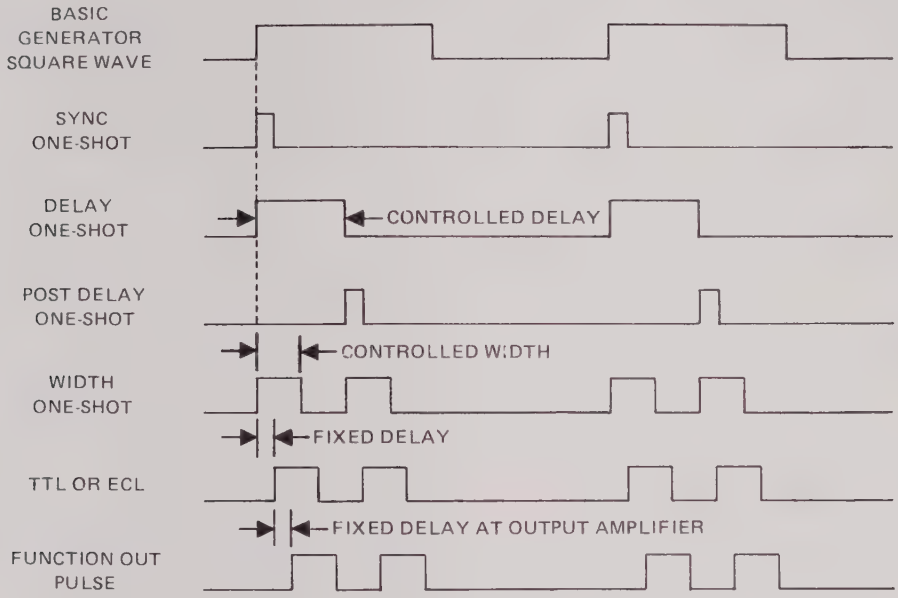


Figure 4-6. Double Mode Timing

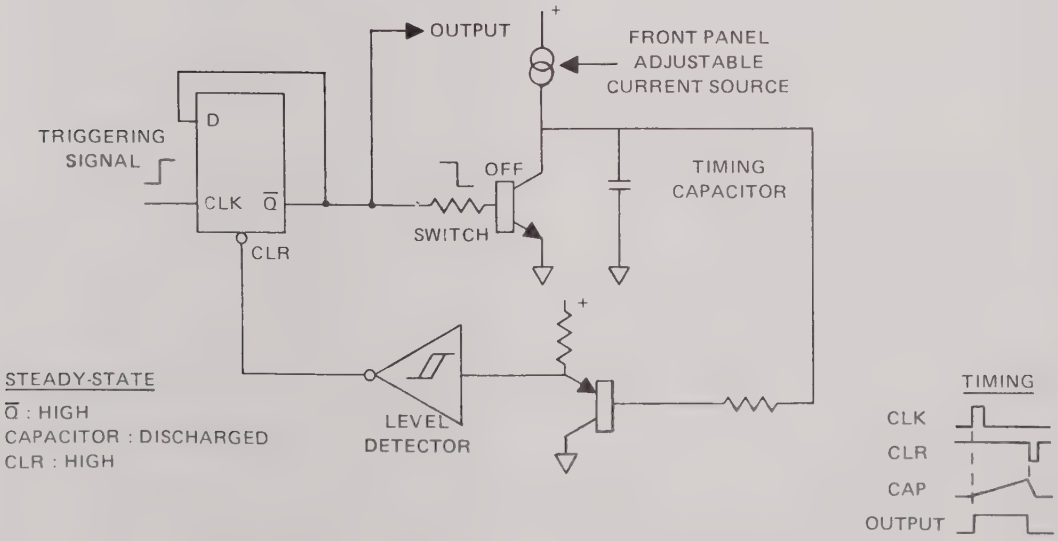


Figure 4-7. Width and Delay One-Shots

SECTION 5
MAINTENANCE

5.1 FACTORY REPAIR

Wavetek maintains a factory repair department for those customers not possessing the necessary personnel or test equipment to maintain the instrument. If an instrument is returned to the factory for calibration or repair, a detailed description of the specific problem should be attached to minimize turnaround time.

5.2 INSPECTION AND PERFORMANCE VERIFICATION

Inspect and verify instrument performance every six months or at a frequency determined from actual instrument usage. Inspect the exterior for damage, cleanness and loose knobs. Use a soft cloth dampened with commercial window cleaner to clean the exterior. When calibrating or repairing the instrument, inspect the instrument interior for heat damage and loose wires. This instrument requires no lubrication. Verify performance by performing the calibration procedures.

5.3 REQUIRED TEST EQUIPMENT

Refer to table 1-1 for equipment required to perform the calibration procedures.

5.4 REMOVING GENERATOR COVERS

WARNING

With covers removed, several dangerous voltage points may be exposed. Contact with these points could cause serious injury or death.

1. Invert the instrument; remove the four screws in the cover.
2. Turn the instrument upright; remove the top cover; and remove the four screws securing the bottom cover.
3. Replace the top cover.

NOTE

Remove the covers only when it is necessary to make adjustments or measurements.

5.5 CALIBRATION

After referring to the following preliminary data, perform calibration, as necessary, per table 5-1. If performing partial calibration, check previous settings and adjustments for applicability. See figures 5-1 and 5-2 for calibration point location.

1. Unless otherwise noted, all measurements made at the 50Ω OUT connector should be terminated into a 50Ω (±0.1%) load.

2. Allow the unit to warm up at least 30 minutes for final calibration. Keep the instrument covers on to maintain heat. Remove covers only to make adjustments or measurements.

3. Verify operation in TRIG and GATE modes by connecting an external generator to the TRIG IN BNC and observing proper operation of TRIGGER LEVEL and TRIGGER START/STOP controls (paragraph 3.1).

4. Verify SYNC OUT is an approximate 30 ns positive pulse into 50Ω and that GCV OUT is a voltage proportional to dial position with a 2V max (open circuit).

5. Properly terminate the TTL, $\overline{\text{TTL}}$, ECL and $\overline{\text{ECL}}$ outputs (paragraph 3.2.1) and verify proper operation (paragraph 3.1)

6. After starting the calibration by connecting the unit to an ac source and setting the front panel switches as follows; invert the instrument.

Dial	.02
FREQ MULT	100K
FREQ VERNIER	Full cw
GENERATOR MODE	CONT
TRIGGER LEVEL	Full ccw
TRIGGER START/STOP	0° CAL
PULSE DELAY	50 ns ▮ 100 ns
PULSE DELAY VARIABLE	cw
Pulse Mode	DOUBLE
PULSE WIDTH	OFF
PULSE WIDTH VARIABLE	12 o'clock
DC OFFSET	OFF
FUNCTION	DC
ATTENUATION	20 ▮ 0
ATTENUATION VERNIER	Full ccw
POWER	ON

Table 5-1. Calibration Chart

Step	Check	Tester	Cal Points	Control Settings	Adjust	Desired Results	Remarks
1	Power Supply	DVM	C111			+15 ±0.05 Vdc	If voltage is incorrect, proceed to step 3.
2			C112			−15 ±0.05 Vdc	If voltage is correct, proceed to step 9.
Steps 3 - 8 are on the trig/pulse board. Place the cover on the generator and turn it upright. Remove the top cover for access to the trig/pulse board.							
3	Power Supply	DVM	TP1 (COM) TP2 (±15 Vdc)		R27	+15 ±0.02 Vdc	
4			TP3			−15 ±0.05 Vdc	
5			TP4			+24 ±1 Vdc	
6			TP5			−24 ±1 Vdc	
7			TP6			+5 ±0.2 Vdc	
8			TP7		R18	−5.2 ±0.01 Vdc	
If steps 3 - 8 were performed, place the cover on, invert the generator and warm up the generator for ½ hour. Remove the uppermost cover for generator board access when necessary.							
9	Cap Mult Balance	DVM (DCV)	TP5 (COM) TP1		R55	< 5 mV	
10	Power Ampl Balance		FUNC-TION OUT		R181	0 ±0.01 Vdc	Terminate with 50Ω load.
11	Preamp Balance			ATTENUATION VERNIER: full cw	R252	0 ±0.01 Vdc	
12	VCG Null	Scope		FUNCTION: ⎍	R12	Minimum frequency shift	Observe one cycle at 50μs/div. Alternately short and open VCG IN BNC while adjusting R12.
13	1000:1 Freq			FREQ VERNIER: full ccw	R13 BOD Freq Adj	< 1 cycle (< 200 Hz)	Scope on .5 ms/div.

Table 5-1. Calibration Chart (Continued)

Step	Check	Tester	Cal Points	Control Settings	Adjust	Desired Results	Remarks
14	1000:1 Sym-metry	Scope	FUNC-TION OUT		R16 BOD Sym	Symmetrical wave-form	*NOTE: Steps 13 and 14 are interactive.*
15	Main Sym-metry			FREQ VERNIER: full cw Dial: 2.0 FREQ MULT: 1K	R35 TOD Sym	Symmetrical wave-form	
16	Sine Distor-tion	Distortion Analyzer, Scope		FUNCTION: ∿	R120 Triangle Balance	Symmetrical residue	Connect FUNCTION OUT to distortion analyzer and distor-tion analyzer output to scope. Set scope to .1V/div. Sync scope to SYNC OUT BNC loaded into 50Ω.
17					R93, R107 Triangle Peaks	Minimum sine distortion	If either adjustment is going near a stop, re-center both pots and return to step 15.
18	Main Freq	Frequency Counter/ Timer		FUNCTION: ⊓⊔	R4 TOD Freq Adj	2000 ±10 Hz	Remove SYNC OUT cable.
19	Cap Mult Freq			FREQ MULT: 10	R48	20 ±0.1 Hz	
20	X 10M Freq			FREQ MULT: 10M Dial: Vary	C40	Best frequency tracking over X 10M range	
21	X 1M Freq			FREQ MULT: 1M Dial: Vary	C34	Best frequency tracking over X 1M range	This adjustment must be made each time step 20 is done.
22	Trigger Baseline	Scope		FUNCTION: ∿ GENERATOR MODE: TRIG Dial: Vary	R162	Minimum shift of baseline around 0 Vdc	

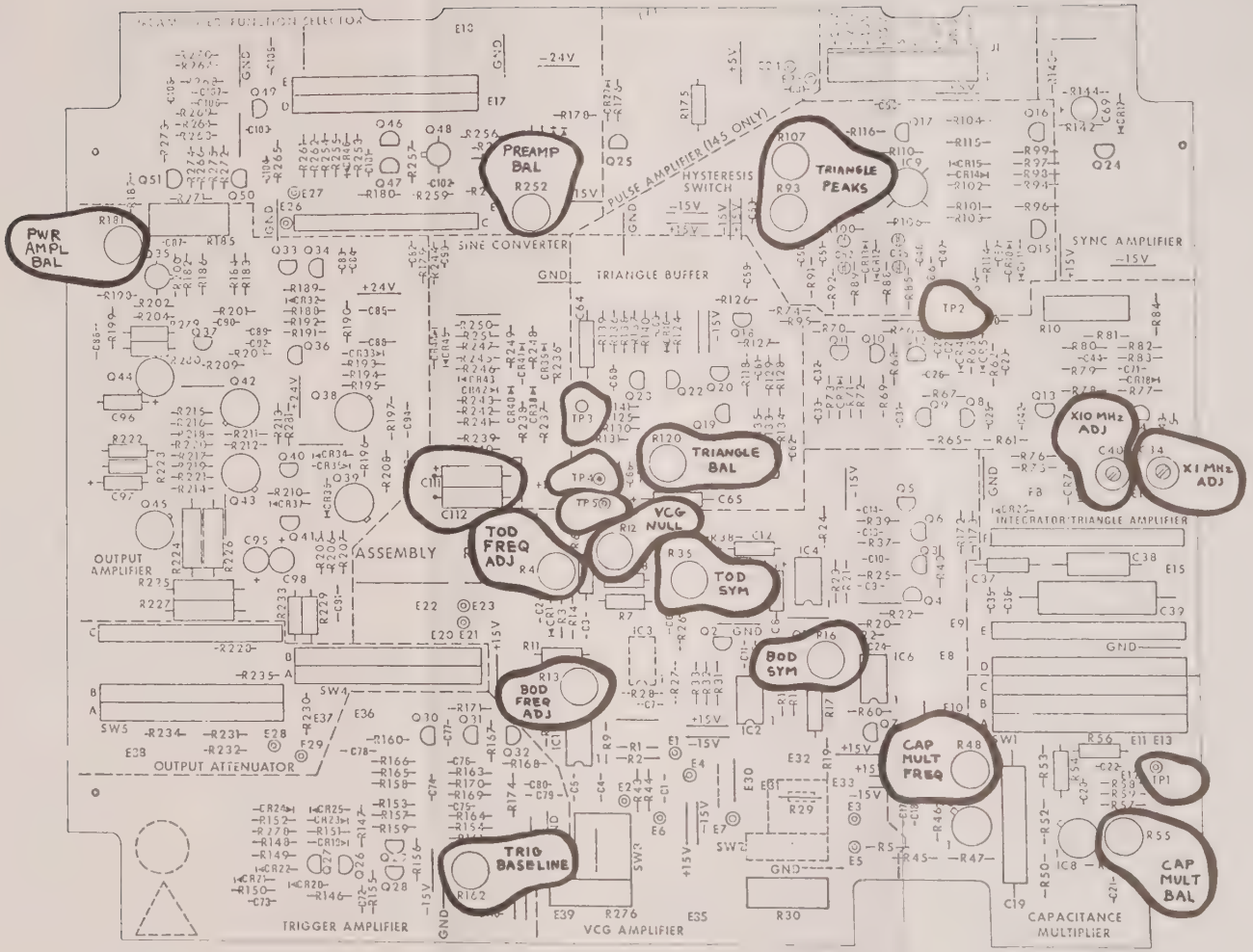


Figure 5-1. Generator Board

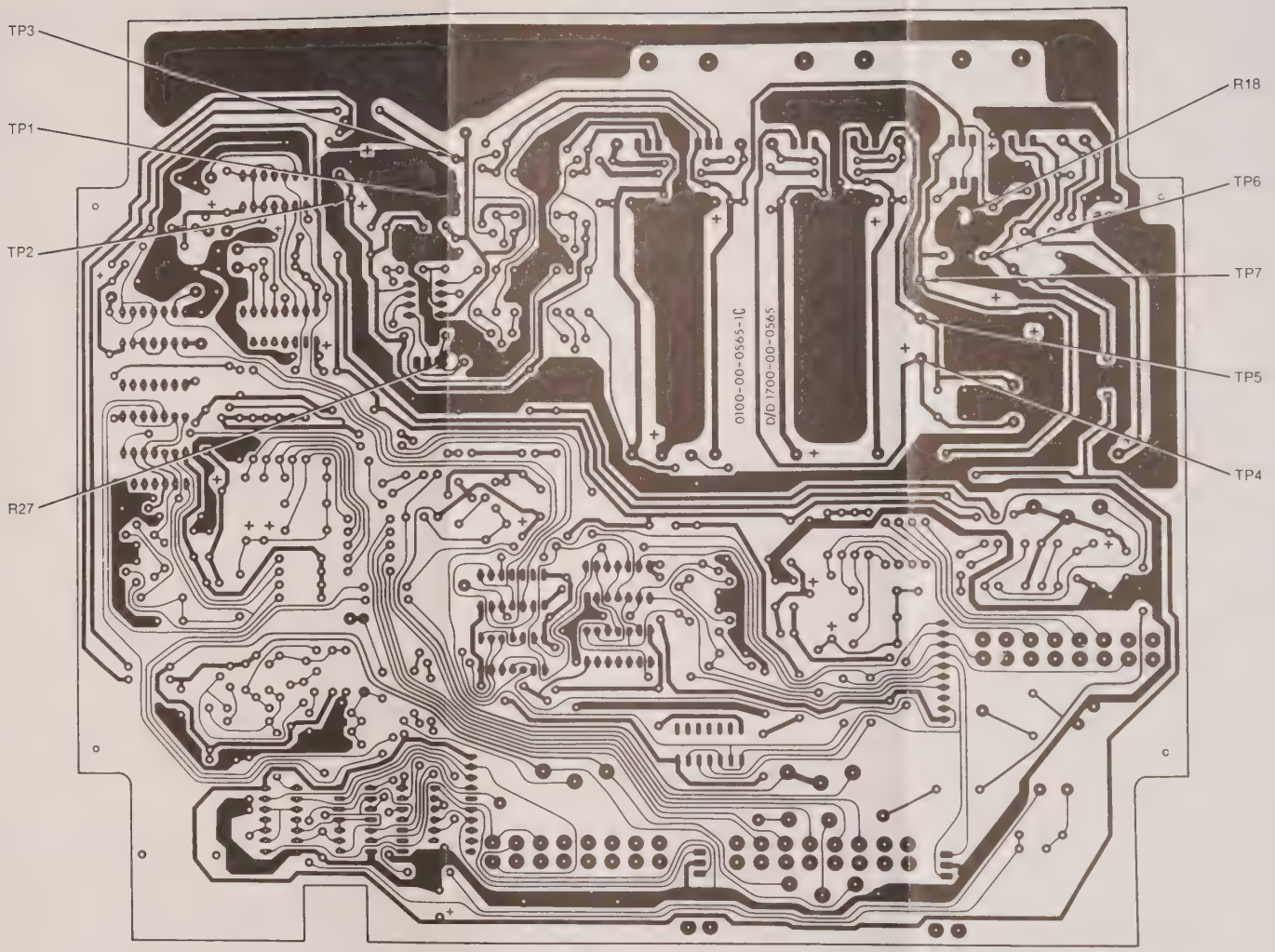


Figure 5-2. Trig/Pulse Board

SECTION 6
TROUBLESHOOTING

6.1 FACTORY REPAIR

Wavetek maintains a factory repair department for those customers not possessing the necessary personnel or test equipment to maintain the instrument. If an instrument is returned to the factory for calibration or repair, a detailed description of the specific problem should be attached to minimize turnaround time.

6.2 TROUBLESHOOTING CHARTS

Troubleshooting charts are given in figures 6-1 thru 6-9. The charts do not cover every possible trouble, but will be an aid in systematically isolating faulty components.

Figure 6-1. Initial Checks, Generator Board
Figure 6-2. Generator Loop Checks, Generator Board
Figure 6-3. VCG Checks, Generator Board
Figure 6-4. Generator Output Checks
Figure 6-5. Trigger and Gate Mode Checks, Trig/Pulse Board
Figure 6-6. Power Supply Checks, Trig/Pulse Board
Figure 6-7. Generator Input and Output Checks
Figure 6-8. Pulse Mode Checks, Trig/Pulse Board
Figure 6-9. Pulse Generator Checks, Trig/Pulse Board

6.3 TROUBLESHOOTING INDIVIDUAL COMPONENTS

6.3.1 Transistor

1. A transistor is defective if more than one volt is measured across its base emitter junction in the forward direction.

2. A transistor when used as a switch may have a few volts reverse bias voltage across base-emitter junction.

3. If the collector and emitter voltages are the same, but the base emitter voltage is less than 500 mV forward voltage (or reversed bias), the transistor is defective.

4. A transistor is defective if its base current is larger than 10% of its emitter current (calculate currents from voltage across the base and emitter series resistors).

5. In a transistor differential pair (common emitter stages), either their base voltages are the same in normal operating condition, or the one with less forward voltage across its base emitter junction should be off (no collector current); otherwise, one of the transistors is defective.

6.3.2 Diode

1. A diode is defective if there is greater than one volt (typically 0.7 volt) forward voltage across it.

6.3.3 Operational Amplifier (e.g., 741, 1458)

1. The "+" and "–" inputs of an operational amplifier will have less than 15 mV voltage difference when operating under normal conditions.

2. When the output of the amplifier is connected to the "–" input (voltage follower connection), the output should be the same voltage as the "+" input voltage; otherwise, the operational amplifier is defective.

6.3.4 Capacitor

1. Shorted capacitors have zero volts across their terminals.

2. Opened capacitor can be located (but not always) by using a good capacitor connected in parallel with the capacitor under test and observing the resulting effect.

6.3.5 Digital TTL IC's (e.g. 7400 Series)

1. The device is operating correctly if the output high state is $>$ +2.4V and low state is $<$ +0.5V.

2. The input must show the same two levels as in step 1. If the levels are between +0.8V and +2.0V, the connection to the driving circuit output is open.

6.4 DISASSEMBLY/REASSEMBLY INSTRUCTIONS (For the Bench Instrument)

6.4.1 Disassembly

WARNING

With covers removed, several dangerous voltage points may be exposed. Contact with these points could cause serious injury or death.

Review the following procedure and identify components using chassis assembly drawing 0102-00-0575 (refer to Section 7).

1. Disconnect the power plug from the line receptacle.

2. Invert the instrument and remove four screws fastening the bottom cover to the top cover.

3. Turn the instrument upright and remove the top cover.

4. Remove the four screws fastening the lower board to the bottom cover standoffs.

5. Remove the instrument from the bottom cover and invert the instrument.

6. Unsolder the No. 18 black wire at the solder lug of FUNCTION OUT BNC.

7. Disconnect the following wires from the generator board locations:

   E28 (coax) and E29 (shield) function output;
   E26 (yellow) and E27 (white-black) Ext DC;
   E6 (green) and E7 (white-black), GCV;
   E1 (brown) and E2 (white-black), VCG;
   E4 (red), E5 (brown) and E3 (orange) dial pot.

8. Remove all knobs except the dial knob.

9. Remove four screws fastening the generator board (upper board in this inverted position) to standoffs between the boards.

10. Tilt the front panel forward and slide it forward enough to clear the detents of the generator board and lift the generator board free. Slide the front panel back over the detents of the remaining board.

11. For troubleshooting, set the generator board component side up on the working surface alongside the rest of the instrument. Ensure that the generator board is lying on a nonconductive surface and it is not making physical contact with the rest of the instrument. A jumper wire may be attached between E3 and E4 of the generator board to simulate a top-of-dial frequency voltage. It may be necessary to replace some of the knobs to set up various test conditions.

    At this point, the entire instrument is accessible for troubleshooting. To reassemble, perform steps 6 through 16, paragraph 6.4.2.

12. To completely remove the generator board, disconnect the following wires from the generator board:

    E21 pulse disable;
    E23 pulse select;
    E24 pulse coax;
    E25 pulse coax shield.

    Disconnect the Molex connector. To reassemble, perform steps 1 through 16, paragraph 6.4.2.

13. To remove the trigger/pulse board, remove the two screws connecting the power switch to the trigger/pulse board.

14. Unsolder the following wires from the trigger/pulse board:

    E1 (blue);
    E2 (white-blue);
    E3 (blue);
    E4 (red);
    E5 (white-red);
    E6 (red);
    E7 (green);
    E8 (green);
    E9 (blue);
    E10 (red);
    E11 (violet);
    E12 (white);
    E13 (white);
    E14 (white);
    E15 (gray);
    E16 (orange);
    E17 (red);
    E18 (white-black);
    E19 (yellow);
    E22 (brown);
    E48 (green);
    E30 (coax, center conductor);
    E31 (coax, shield);
    J6 ($\overline{\text{TTL}}$ BNC), E40 and E41;
    J5 ($\overline{\text{TTL}}$ BNC), E42 and E43;
    J4 ($\overline{\text{ECL}}$ BNC), E44 and E47;
    J3 ($\overline{\text{ECL}}$ BNC), E45 and E46.

15. Unsolder the green-yellow wire connecting the front and rear panels.

16. Slide out the trigger/pulse board.

6.4.2 Reassembly

Refer to the chassis assembly drawing 0102-00-0575 (refer to Section 7) for correct positioning of the reassembled components.

1. Turn the unit upside down (bottom of unit up).

2. Insert the trigger/pulse board (component side up).

3. Solder the following wires to the board:

   E1 (blue);
   E2 (white-blue);
   E3 (blue);
   E4 (red);
   E5 (white-red);
   E6 (red);
   E7 (green);
   E8 (green);
   E30 (coax-center conductor);
   E31 (coax-shield);
   J6 ($\overline{\text{TTL}}$ BNC), E40 and E41;
   J5 ($\overline{\text{TTL}}$ BNC), E42 and E43;
   J4 ($\overline{\text{ECL}}$ BNC), E44 and E47;
   J3 ($\overline{\text{ECL}}$ BNC), E45 and E46;
   E9 (blue);
   E10 (red);
   E11 (violet);
   E12 (white);
   E13 (white);
   E14 (white);
   E15 (gray);
   E16 (orange);
   E17 (red);
   E18 (white-black);
   E19 (yellow);
   E22 (brown);
   E48 (green).

4. Secure the power switch to the trigger/pulse board.

5. Solder the green-yellow wire connecting the front and rear panels.

6. Slide in the generator board (component side up).

7. Secure the four screws attaching the generator and trigger/pulse boards together.

8. Install the two screws securing the generator to the left side panel mounting brackets.

9. Push the front panel back over the board detents.

10. Connect the following wires to the generator board:

    E4 (red), E5 (brown) and E3 (orange) dial pot;
    E1 (brown) and E2 (white-black) VCG;
    E6 (green) and E7 (white-black) GCV;
    E28 (coax, center conductor) and E29 (coax shield);
    E26 (yellow) and E27 (white-black) Ext DC;
    E23 from E34 of trigger/pulse board;
    E21 from E39 of trigger/pulse board;
    E24 from E37 of trigger/pulse board;
    E25 from E38 of trigger/pulse board.

    Connect the Molex connector.

11. Solder the large No. 18 ground wire to the output BNC.

12. Turn the instrument upright and slide front and rear panels into the bottom cover. This spaces them correctly for proper knob alignment.

13. Install all knobs. Align them so that they match the front panel graphics and are spaced approximately 1/16th of an inch away from the surface the front panel.

14. Install four screws to secure the lower board to the bottom cover standoffs

15. Replace the top cover and invert the instrument.

16. Secure the top cover with four screws into bottom cover.

6.5 DISASSEMBLY/REASSEMBLY INSTRUCTIONS (For the Rack Mounted Instrument)

6.5.1 Disassembly

Review the following procedure and identify components using drawings 0102-00-0621 and 0102-00-0575 (refer to Section 7).

1. Disconnect the power plug from the line receptacle.

2. Turn the unit top side up.

3. Remove the four top cover screws and cover.

4. Invert the unit (bottom side up).

5. Remove the four bottom cover screws and cover.

6. Remove all front panel knobs except the frequency dial knob.

7. Position the unit upside down (bottom of unit) with the front panel away from you.

8. Remove the three screws holding the heat sinks of the trigger/pulse board to the rear panel.

9. Remove the two screws attaching the front panel to the right side panel (labeled "R.H." in drawing 0102-00-0621).

10. Remove the two screws securing the rear panel to the left side panel.

11. Remove the two screws securing the generator board to the left side panel mounting brackets.

12. Unsolder the large No. 18 (black) ground on the function output BNC.

13. To remove the generator board, disconnect the following wires from the generator board locations:

    E28 (coax) and E29 (shield), function output;
    E26 (yellow) and E27 (white-black), Ext DC;
    E6 (green) and E7 (white-black), GCV;
    E1 (brown) and E2 (white-black), VCG;
    E4 (red), E5 (brown) and E3 (orange), dial pot;
    E23 (pulse select);
    E21 (pulse disable);
    E24 (pulse coax);
    E25 (pulse coax shield).

    Disconnect the Molex connector.

14. Slide the rear panel to the right and backwards. Notice that the wires for the power supply are connected to the rear panel.

15. Remove the two screws attaching the generator board to the mounting brackets on the right side panel.

16. Remove the four screws securing the generator and trigger/pulse boards together.

17. Remove the main board back and upwards.

18. For troubleshooting the generator and trigger/pulse boards, turn the instrument around with the front panel facing you (keep the unit inverted). Place the generator board (component side up) on a working surface with the board on the right side of the unit. Ensure the generator board is lying on a nonconductive surface and not making physical contact with the rest of the unit. Jumper E3 and E4 simulate the top of dial frequency voltage. Pull J1 (Molex connector) from the instrument and plug into position on the generator board. Add the following jumpers between the generator and trigger/pulse board:

Trigger/Pulse	Generator
E34 (pulse select)	E23
E39 (pulse disable)	E21
E37 (pulse coax, center)	E24
E38 (pulse coax, shield)	E25

    It may be necessary to replace some of the knobs to set up various test conditions.

    At this point, the entire instrument is accessible for troubleshooting. To reassemble, perform steps 6 through 19, paragraph 6.5.2.

19. To remove the trigger/pulse board, remove the two screws connecting the power switch to the trigger/pulse board.

20. Unsolder the following wires from the trigger/pulse board:

    E1 (blue);
    E2 (white-blue);
    E3 (blue);
    E4 (red);
    E5 (white-red);
    E6 (red);
    E7 (green);
    E8 (green);
    E9 (blue);
    E10 (red);
    E11 (violet);
    E12 (white);
    E13 (white);
    E14 (white);
    E15 (gray);
    E16 (orange);
    E17 (red);
    E18 (white-black);
    E19 (yellow);

E22 (brown);
E48 (green);
E30 (coax, center conductor);
E31 (coax, shield);
J6 (TTL BNC), E40 and E41;
J5 ($\overline{\text{TTL}}$ BNC), E42 and E43;
J4 (ECL BNC), E44 and E47;
J3 ($\overline{\text{ECL}}$ BNC), E45 and E46.

21. Unsolder the green-yellow wire connecting the front and rear panels.

22. Slide out the trigger/pulse board.

6.5.2 Reassembly

Review the following procedure and identify components using drawings 0102-00-0621 and 0102-00-0575 (refer to Section 7).

1. Turn the unit upside down (bottom of unit up).

2. Insert the trigger/pulse board (component side up).

3. Solder the following wires to the board:

4. Secure the power switch to the trigger/pulse board.

E1 (blue);
E2 (white-blue);
E3 (blue);
E4 (red);
E5 (white-red);
E6 (red);
E7 (green);
E8 (green);
E30 (coax-center conductor);
E31 (coax-shield);
J6 (TTL BNC), E40 and E41;
J5 ($\overline{\text{TTL}}$ BNC), E42 and E43;
J4 (ECL BNC), E44 and E47;
J3 ($\overline{\text{ECL}}$ BNC), E45 and E46;
E9 (blue);
E10 (red);
E11 (violet);
E12 (white);
E13 (white);
E14 (white);
E15 (gray);
E16 (orange);
E17 (red);
E18 (white-black);
E19 (yellow);
E22 (brown);
E48 (green).

5. Solder the green-yellow wire connecting the front and rear panels.

6. Slide in the generator board (component side up).

7. Secure the four screws attaching the generator and trigger/pulse boards together.

8. Install the two screws securing the generator to the left side panel mounting brackets.

9. Attach all knobs to the front panel.

10. Slide the rear panel and right side panel into position. Align the wires with notched locations on the generator board.

11. Install the two screws securing the rear and left side panel.

12. Secure the front and right side panels with two screws.

13. Install the two screws securing the generator to the right side panel mounting brackets.

14. Secure the heat sink to the rear panel using three screws.

15. Connect the following wires to the generator board:

E4 (red), E5 (brown) and E3 (orange) dial pot;
E1 (brown) and E2 (white-black) VCG;
E6 (green) and E7 (white-black) GCV;
E28 (coax, center conductor) and E29 (coax shield);
E26 (yellow) and E27 (white-black) Ext DC;
E23 from E34 of trigger/pulse board;
E21 from E39 of trigger/pulse board;
E24 from E37 of trigger/pulse board;
E25 from E38 of trigger/pulse board;

Connect the Molex connector.

16. Solder the large No. 18 ground wire to the output BNC.

17. Visually inspect the instrument for missing hardware and disconnected wires.

18. Attach top and bottom covers with four screws for each cover.

19. Check the unit for proper operation.

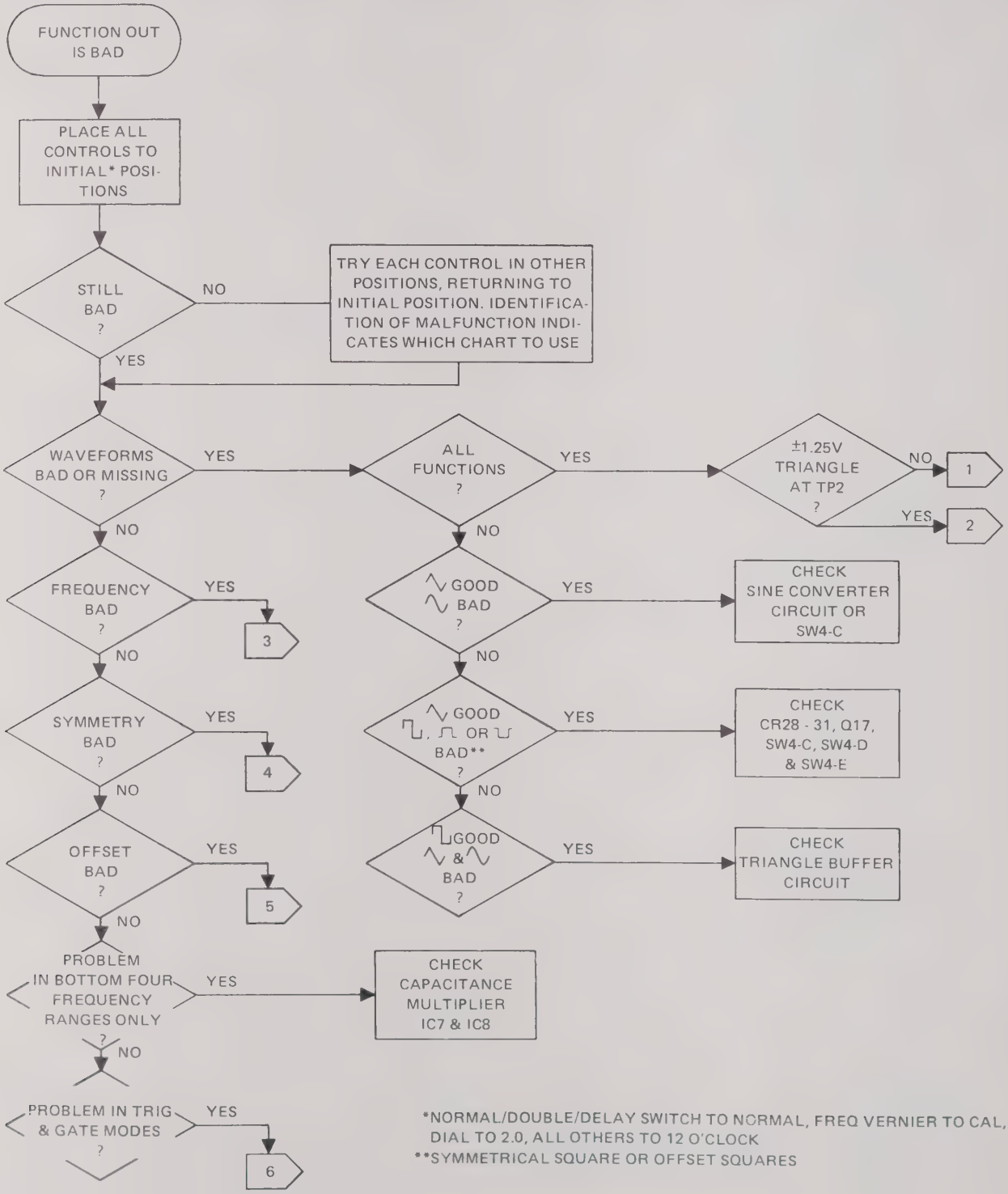


Figure 6-1. Initial Checks, Generator Board

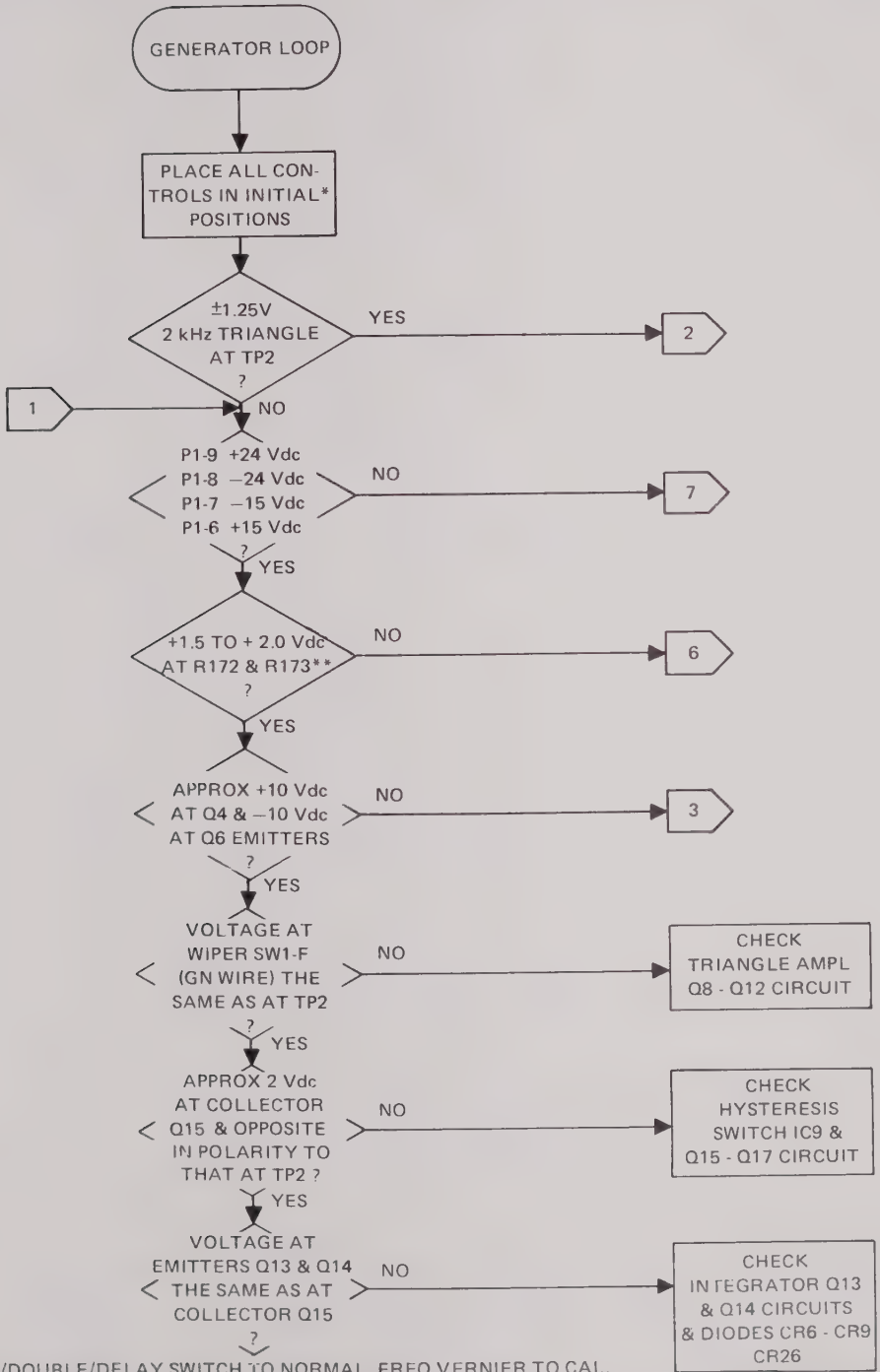
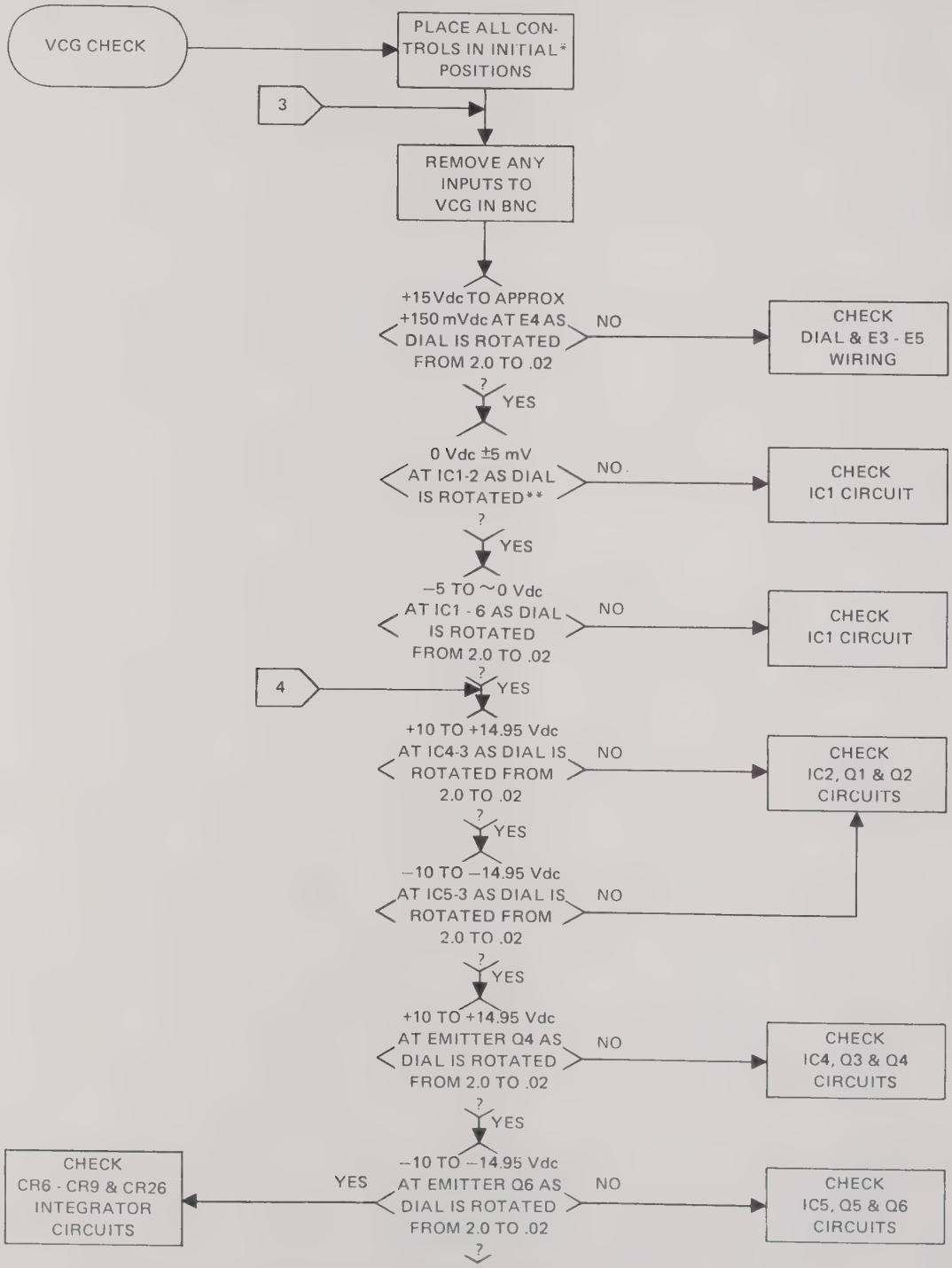

GENERATOR LOOP
PLACE ALL CONTROLS IN INITIAL* POSITIONS
±1.25V 2 kHz TRIANGLE AT TP2 ?
YES
2
1
NO
P1-9 +24 Vdc
P1-8 −24 Vdc
P1-7 −15 Vdc
P1-6 +15 Vdc
?
NO
7
YES
+1.5 TO + 2.0 Vdc AT R172 & R173** ?
NO
6
YES
APPROX +10 Vdc AT Q4 & −10 Vdc AT Q6 EMITTERS
?
NO
3
YES
VOLTAGE AT WIPER SW1-F (GN WIRE) THE SAME AS AT TP2
?
NO
CHECK TRIANGLE AMPL Q8 - Q12 CIRCUIT
YES
APPROX 2 Vdc AT COLLECTOR Q15 & OPPOSITE IN POLARITY TO THAT AT TP2 ?
NO
CHECK HYSTERESIS SWITCH IC9 & Q15 - Q17 CIRCUIT
YES
VOLTAGE AT EMITTERS Q13 & Q14 THE SAME AS AT COLLECTOR Q15
?
NO
CHECK INTEGRATOR Q13 & Q14 CIRCUITS & DIODES CR6 - CR9 CR26
*NORMAL/DOUBLE/DELAY SWITCH TO NORMAL, FREQ VERNIER TO CAL, DIAL TO 2.0, ALL OTHERS TO 12 O'CLOCK
**A NEGATIVE VOLTAGE HERE STOPS GENERATOR FOR TRIGGERED OPERATION
***USE SCOPE AND HIGH IMPEDANCE PROBE

Figure 6-2. Generator Loop Checks, Generator Board


VCG CHECK
PLACE ALL CONTROLS IN INITIAL* POSITIONS
3
REMOVE ANY INPUTS TO VCG IN BNC
+15 Vdc TO APPROX +150 mVdc AT E4 AS DIAL IS ROTATED FROM 2.0 TO .02
NO
CHECK DIAL & E3 - E5 WIRING
YES
0 Vdc ±5 mV AT IC1-2 AS DIAL IS ROTATED**
NO
CHECK IC1 CIRCUIT
YES
−5 TO ~0 Vdc AT IC1 - 6 AS DIAL IS ROTATED FROM 2.0 TO .02
NO
CHECK IC1 CIRCUIT
4
YES
+10 TO +14.95 Vdc AT IC4-3 AS DIAL IS ROTATED FROM 2.0 TO .02
NO
CHECK IC2, Q1 & Q2 CIRCUITS
YES
−10 TO −14.95 Vdc AT IC5-3 AS DIAL IS ROTATED FROM 2.0 TO .02
NO
YES
+10 TO +14.95 Vdc AT EMITTER Q4 AS DIAL IS ROTATED FROM 2.0 TO .02
NO
CHECK IC4, Q3 & Q4 CIRCUITS
YES
−10 TO −14.95 Vdc AT EMITTER Q6 AS DIAL IS ROTATED FROM 2.0 TO .02
YES
CHECK CR6 - CR9 & CR26 INTEGRATOR CIRCUITS
NO
CHECK IC5, Q5 & Q6 CIRCUITS

*NORMAL/DOUBLE/DELAY SWITCH TO NORMAL, FREQ VERNIER TO CAL, DIAL TO 2.0, ALL OTHERS TO 12 O'CLOCK

**USE SCOPE AND HIGH IMPEDANCE PROBE FOR THIS AND SUBSEQUENT VCG MEASUREMENTS

Figure 6-3. VCG Checks, Generator Board

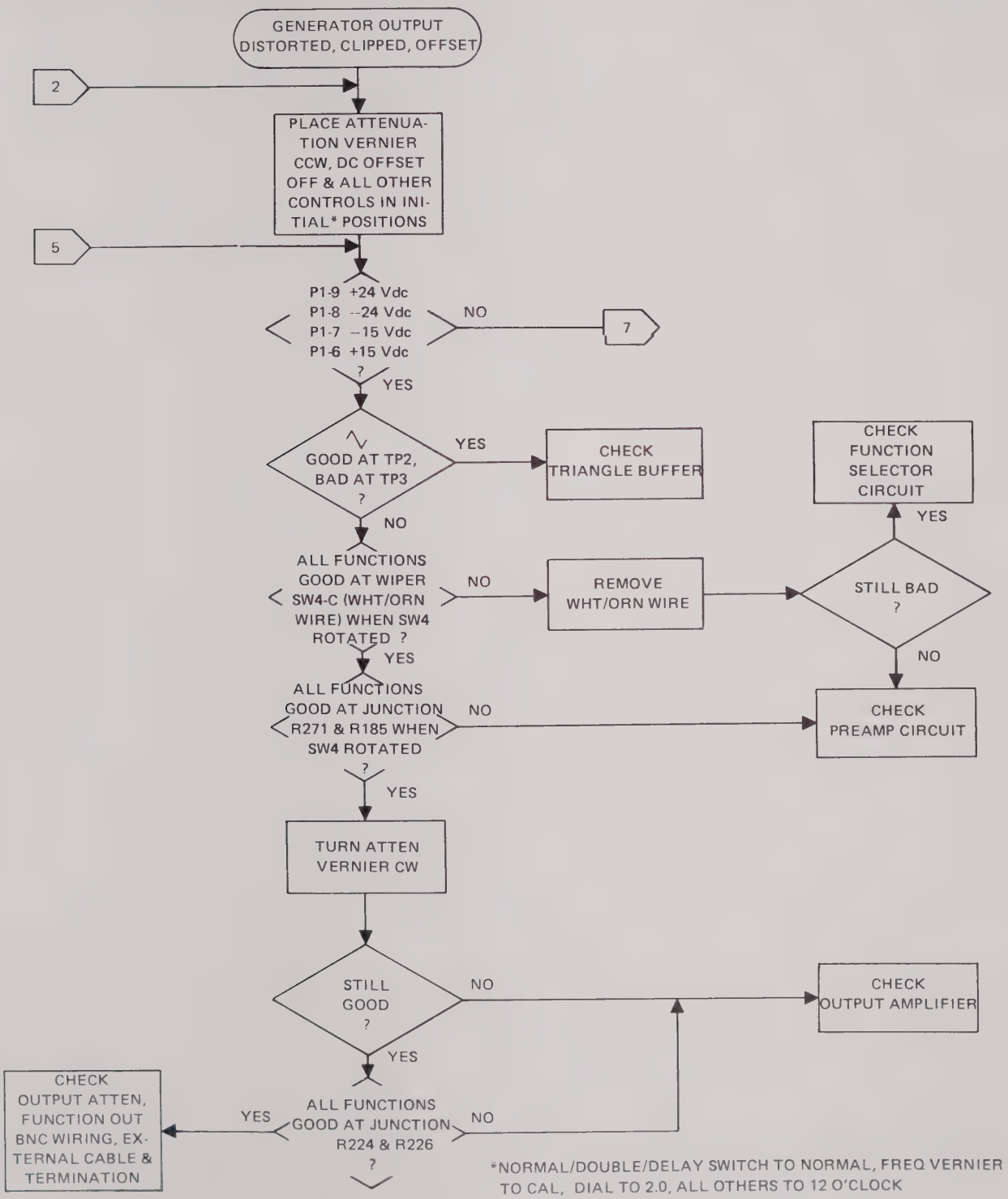
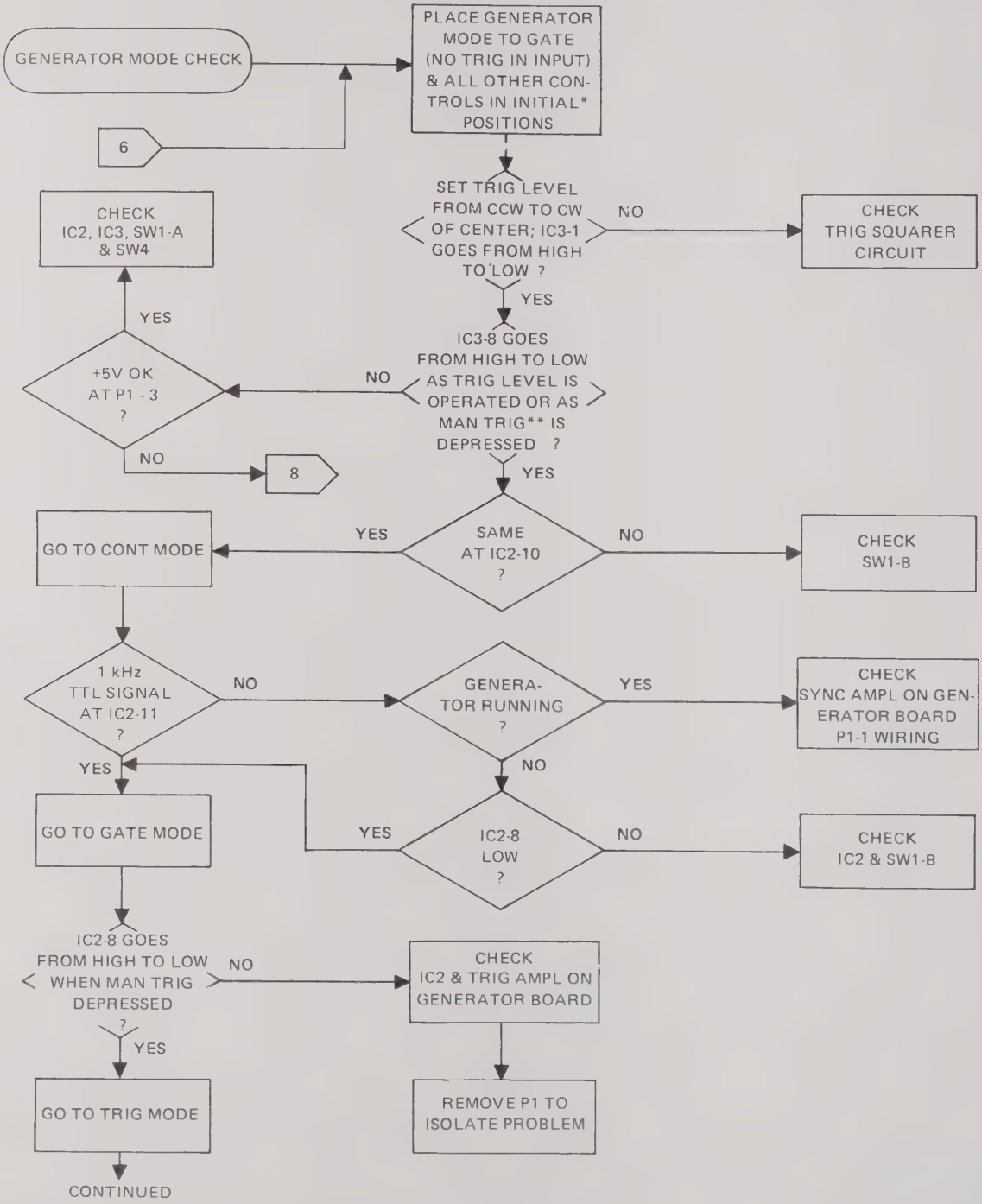


Figure 6-4. Generator Output Checks, Generator Board


GENERATOR MODE CHECK
PLACE GENERATOR MODE TO GATE (NO TRIG IN INPUT) & ALL OTHER CONTROLS IN INITIAL* POSITIONS
6
SET TRIG LEVEL FROM CCW TO CW OF CENTER; IC3-1 GOES FROM HIGH TO LOW ?
NO
CHECK TRIG SQUARER CIRCUIT
YES
CHECK IC2, IC3, SW1-A & SW4
YES
+5V OK AT P1 - 3 ?
NO
IC3-8 GOES FROM HIGH TO LOW AS TRIG LEVEL IS OPERATED OR AS MAN TRIG** IS DEPRESSED ?
NO
8
YES
GO TO CONT MODE
YES
SAME AT IC2-10 ?
NO
CHECK SW1-B
1 kHz TTL SIGNAL AT IC2-11 ?
NO
GENERATOR RUNNING ?
YES
CHECK SYNC AMPL ON GENERATOR BOARD P1-1 WIRING
YES
NO
GO TO GATE MODE
YES
IC2-8 LOW ?
NO
CHECK IC2 & SW1-B
IC2-8 GOES FROM HIGH TO LOW WHEN MAN TRIG DEPRESSED ?
NO
CHECK IC2 & TRIG AMPL ON GENERATOR BOARD
YES
GO TO TRIG MODE
REMOVE P1 TO ISOLATE PROBLEM
CONTINUED

*NORMAL/DOUBLE/DELAY SWITCH TO NORMAL, FREQ VERNIER TO CAL, DIAL TO 2.0, ALL OTHERS TO 12 O'CLOCK

**RETURN TRIG LEVEL CCW TO OPERATE MANUAL TRIGGER

Figure 6-5. Trigger and Gate Mode Checks, Trig/Pulse Board (Page 1 of 2)

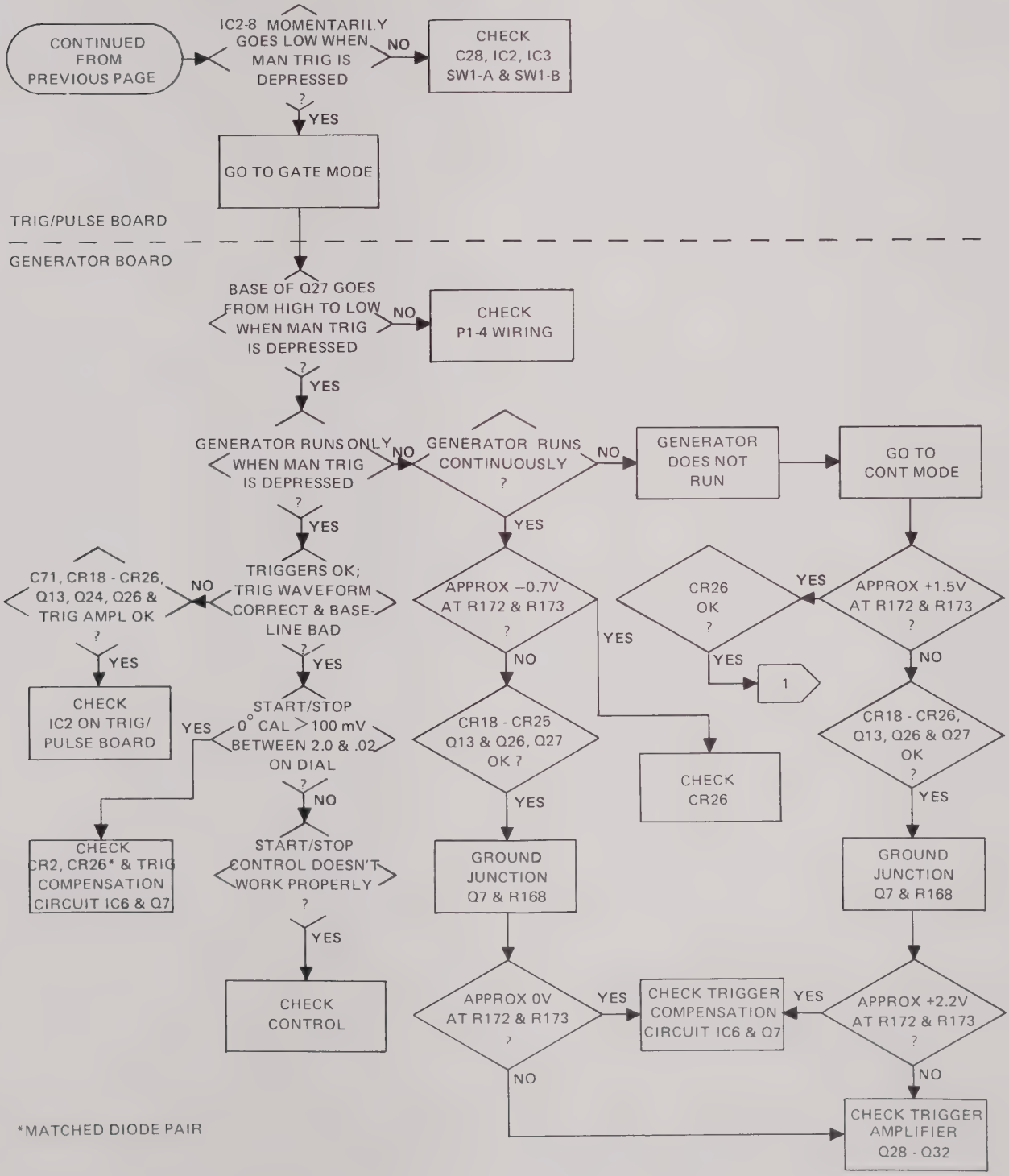


Figure 6-5. Trigger and Gate Mode Checks, Trig/Pulse Board (Page 2 of 2)

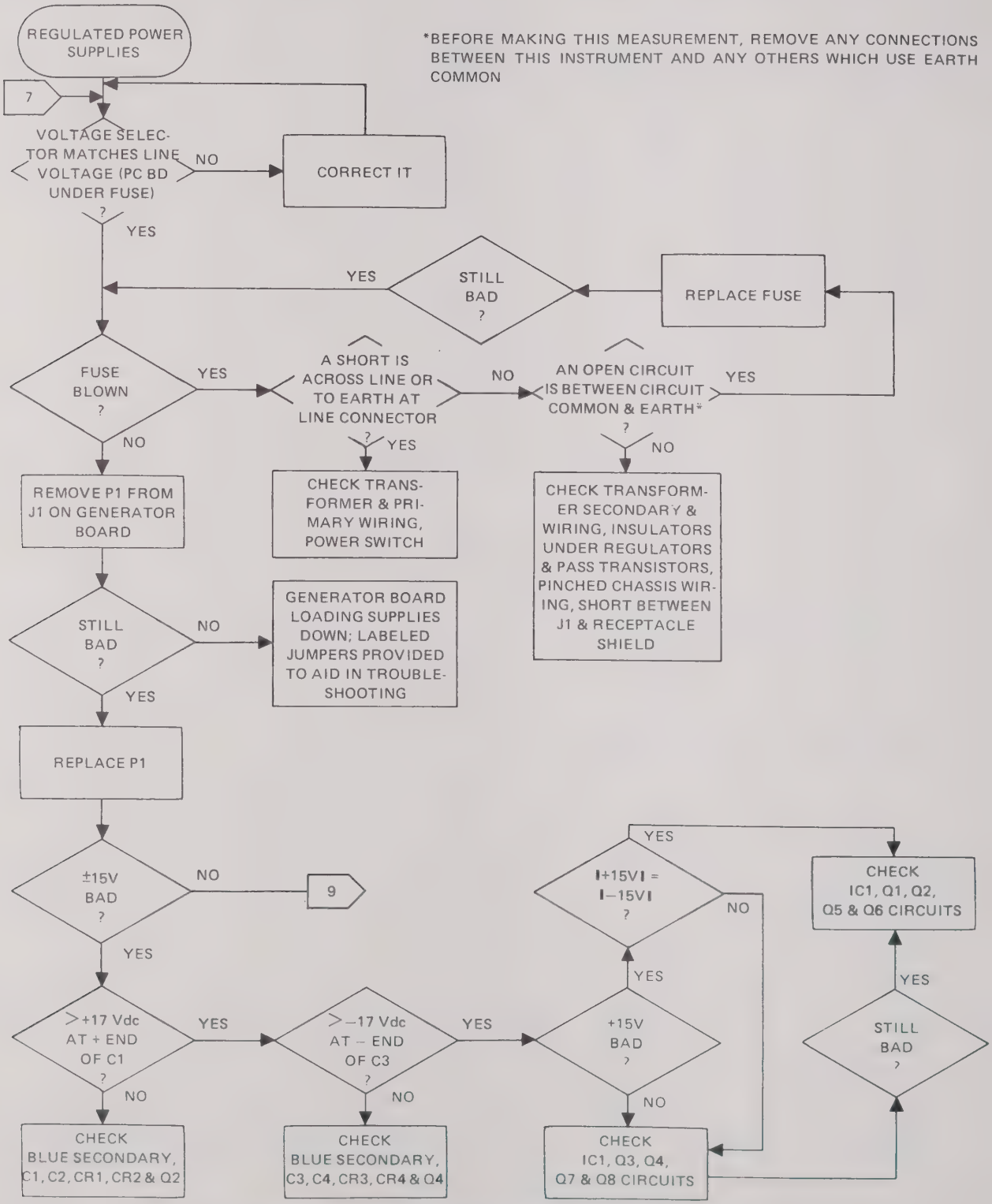

REGULATED POWER SUPPLIES
*BEFORE MAKING THIS MEASUREMENT, REMOVE ANY CONNECTIONS BETWEEN THIS INSTRUMENT AND ANY OTHERS WHICH USE EARTH COMMON
7
VOLTAGE SELECTOR MATCHES LINE VOLTAGE (PC BD UNDER FUSE) ?
NO
CORRECT IT
YES
STILL BAD ?
YES
REPLACE FUSE
FUSE BLOWN ?
YES
A SHORT IS ACROSS LINE OR TO EARTH AT LINE CONNECTOR ?
NO
AN OPEN CIRCUIT IS BETWEEN CIRCUIT COMMON & EARTH* ?
YES
NO
YES
CHECK TRANSFORMER & PRIMARY WIRING, POWER SWITCH
CHECK TRANSFORMER SECONDARY & WIRING, INSULATORS UNDER REGULATORS & PASS TRANSISTORS, PINCHED CHASSIS WIRING, SHORT BETWEEN J1 & RECEPTACLE SHIELD
REMOVE P1 FROM J1 ON GENERATOR BOARD
STILL BAD ?
NO
GENERATOR BOARD LOADING SUPPLIES DOWN; LABELED JUMPERS PROVIDED TO AID IN TROUBLESHOOTING
YES
REPLACE P1
±15V BAD ?
NO
9
YES
>+17 Vdc AT + END OF C1 ?
YES
>−17 Vdc AT − END OF C3 ?
YES
+15V BAD ?
YES
|+15V| = |−15V| ?
NO
YES
CHECK IC1, Q1, Q2, Q5 & Q6 CIRCUITS
YES
STILL BAD ?
NO
CHECK IC1, Q3, Q4, Q7 & Q8 CIRCUITS
NO
CHECK BLUE SECONDARY, C3, C4, CR3, CR4 & Q4
NO
CHECK BLUE SECONDARY, C1, C2, CR1, CR2 & Q2

Figure 6-6. Power Supply Checks, Trig/Pulse Board (Page 1 of 2)

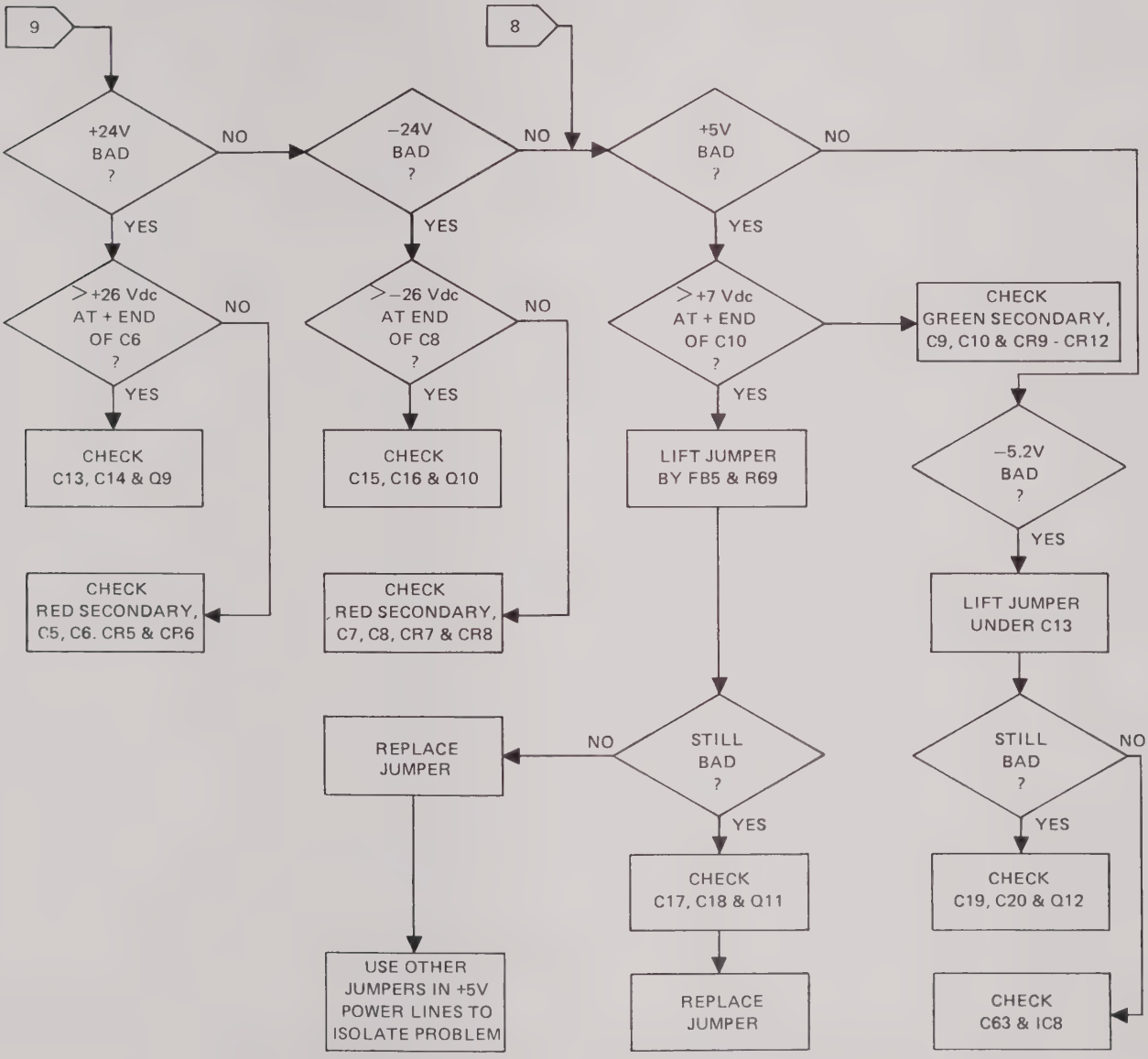


Figure 6-6. Power Supply Checks, Trig/Pulse Board (Page 2 of 2)

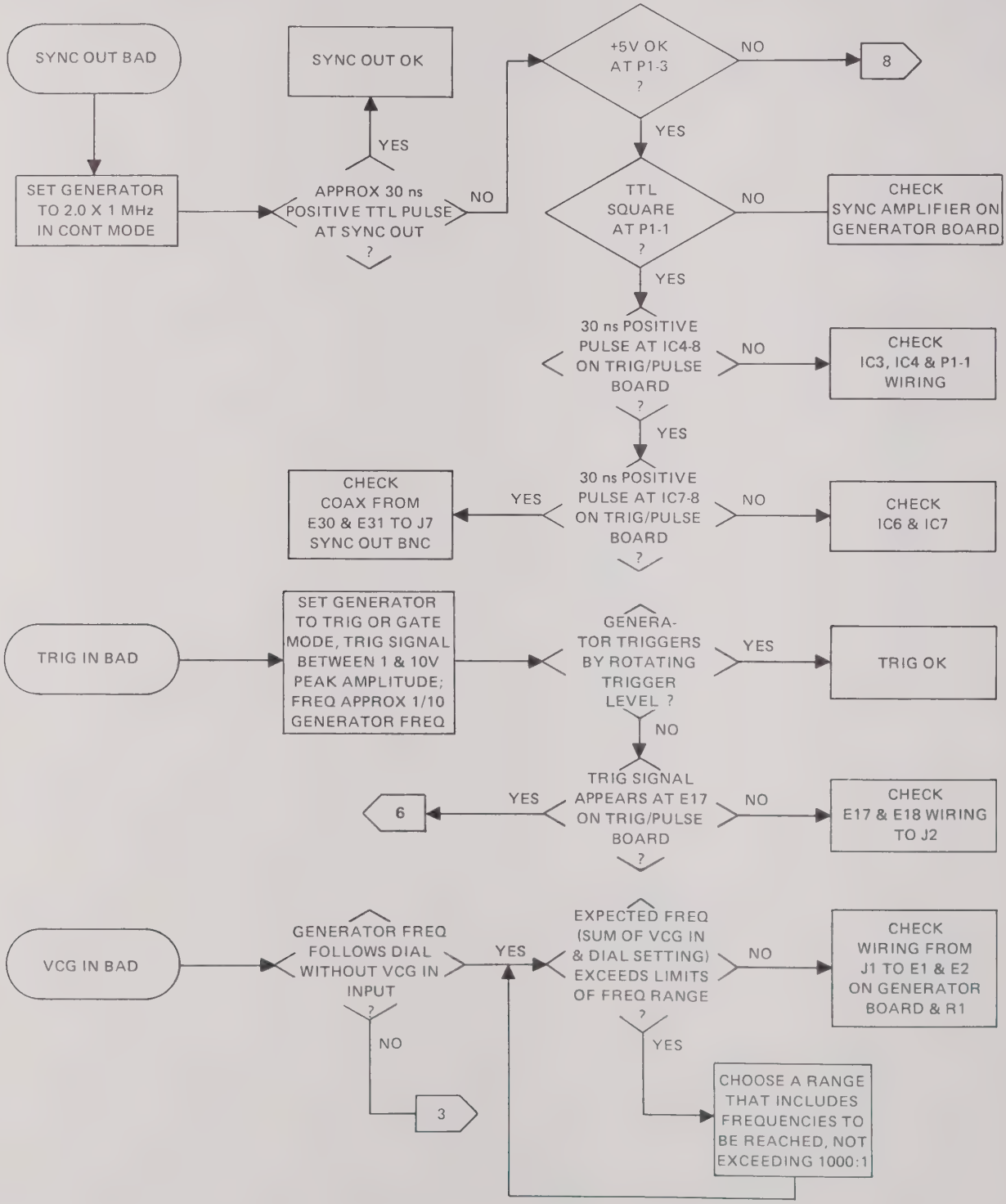

SYNC OUT BAD
SET GENERATOR TO 2.0 X 1 MHz IN CONT MODE
APPROX 30 ns POSITIVE TTL PULSE AT SYNC OUT ?
NO
YES
SYNC OUT OK
+5V OK AT P1-3 ?
NO
8
YES
TTL SQUARE AT P1-1 ?
NO
CHECK SYNC AMPLIFIER ON GENERATOR BOARD
YES
30 ns POSITIVE PULSE AT IC4-8 ON TRIG/PULSE BOARD ?
NO
CHECK IC3, IC4 & P1-1 WIRING
YES
30 ns POSITIVE PULSE AT IC7-8 ON TRIG/PULSE BOARD ?
NO
CHECK IC6 & IC7
YES
CHECK COAX FROM E30 & E31 TO J7 SYNC OUT BNC
TRIG IN BAD
SET GENERATOR TO TRIG OR GATE MODE, TRIG SIGNAL BETWEEN 1 & 10V PEAK AMPLITUDE; FREQ APPROX 1/10 GENERATOR FREQ
GENERATOR TRIGGERS BY ROTATING TRIGGER LEVEL ?
YES
TRIG OK
NO
TRIG SIGNAL APPEARS AT E17 ON TRIG/PULSE BOARD ?
NO
CHECK E17 & E18 WIRING TO J2
YES
6
VCG IN BAD
GENERATOR FREQ FOLLOWS DIAL WITHOUT VCG IN INPUT ?
YES
EXPECTED FREQ (SUM OF VCG IN & DIAL SETTING) EXCEEDS LIMITS OF FREQ RANGE ?
NO
CHECK WIRING FROM J1 TO E1 & E2 ON GENERATOR BOARD & R1
YES
CHOOSE A RANGE THAT INCLUDES FREQUENCIES TO BE REACHED, NOT EXCEEDING 1000:1
NO
3

Figure 6-7. Generator Input and Output Checks (Page 1 of 2)

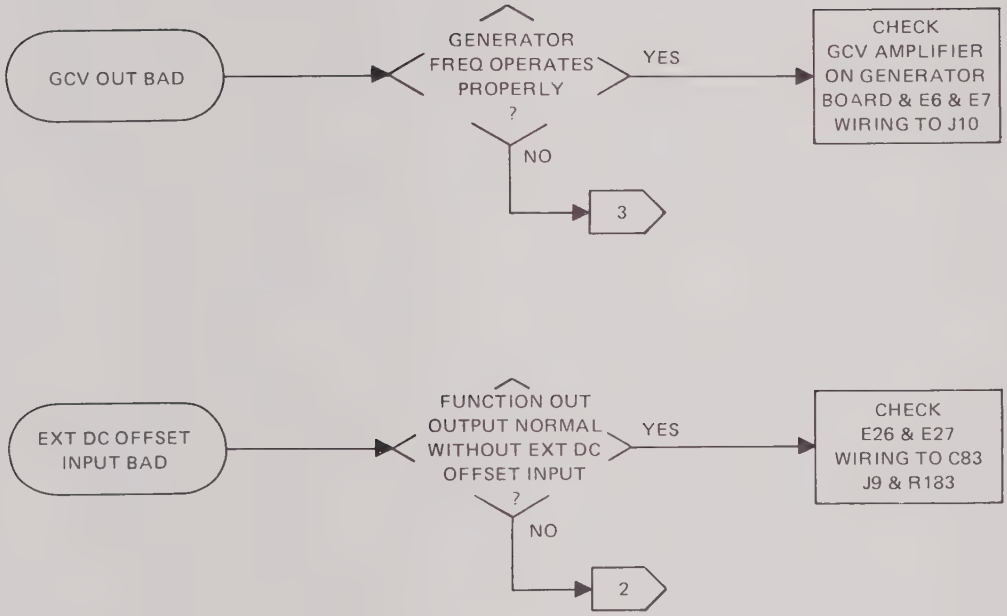

GCV OUT BAD
GENERATOR FREQ OPERATES PROPERLY ?
YES
CHECK GCV AMPLIFIER ON GENERATOR BOARD & E6 & E7 WIRING TO J10
NO
3
EXT DC OFFSET INPUT BAD
FUNCTION OUT OUTPUT NORMAL WITHOUT EXT DC OFFSET INPUT ?
YES
CHECK E26 & E27 WIRING TO C83 J9 & R183
NO
2

Figure 6-7. Generator Input and Output Checks (Page 2 of 2)

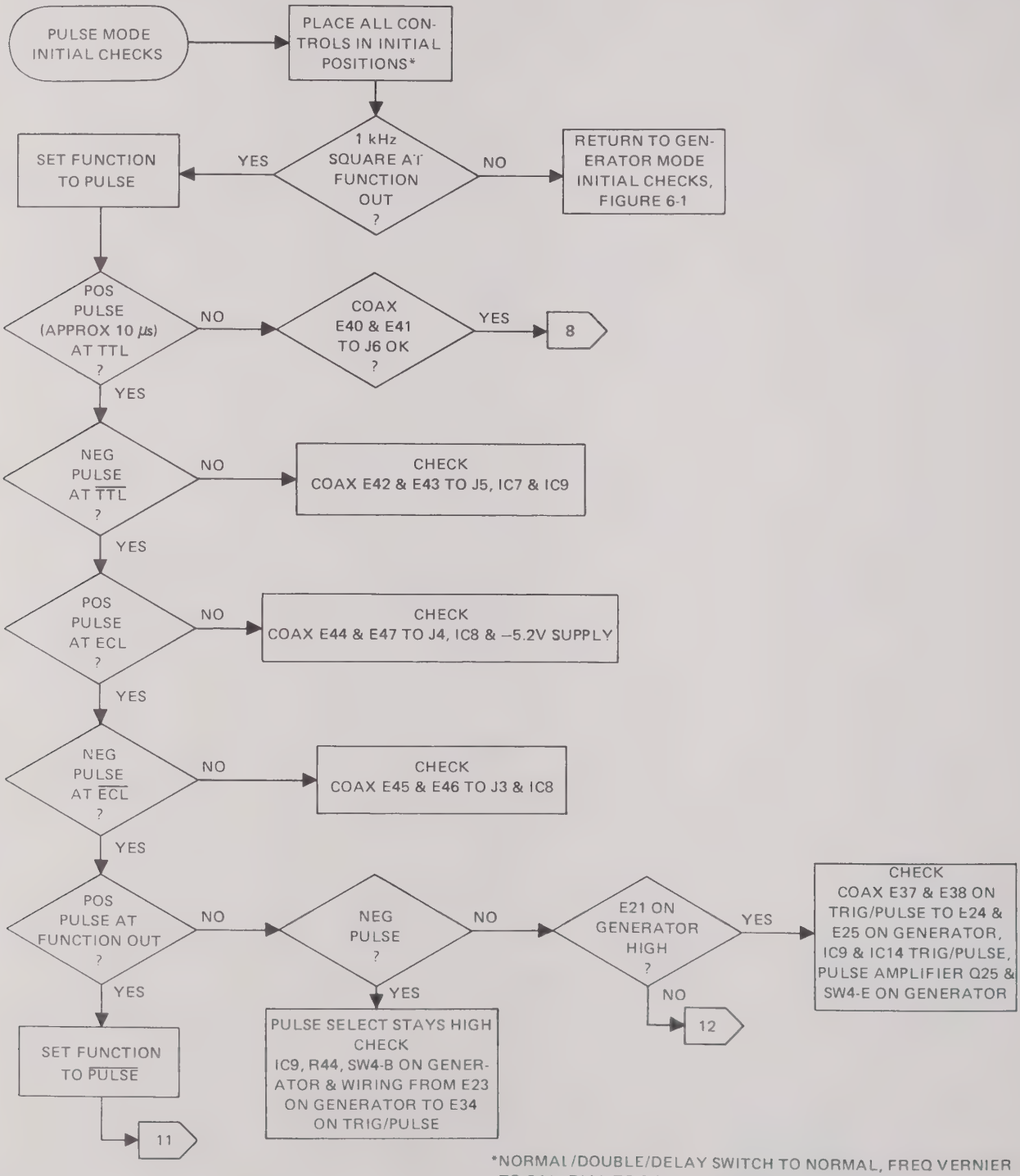

PULSE MODE INITIAL CHECKS
PLACE ALL CONTROLS IN INITIAL POSITIONS*
1 kHz SQUARE AT FUNCTION OUT ?
YES
NO
SET FUNCTION TO PULSE
RETURN TO GENERATOR MODE INITIAL CHECKS, FIGURE 6-1
POS PULSE (APPROX 10 µs) AT TTL ?
NO
COAX E40 & E41 TO J6 OK ?
YES
8
YES
NEG PULSE AT TTL ?
NO
CHECK COAX E42 & E43 TO J5, IC7 & IC9
YES
POS PULSE AT ECL ?
NO
CHECK COAX E44 & E47 TO J4, IC8 & –5.2V SUPPLY
YES
NEG PULSE AT ECL ?
NO
CHECK COAX E45 & E46 TO J3 & IC8
YES
POS PULSE AT FUNCTION OUT ?
NO
NEG PULSE ?
NO
E21 ON GENERATOR HIGH ?
YES
CHECK COAX E37 & E38 ON TRIG/PULSE TO E24 & E25 ON GENERATOR, IC9 & IC14 TRIG/PULSE, PULSE AMPLIFIER Q25 & SW4-E ON GENERATOR
YES
NO
12
YES
PULSE SELECT STAYS HIGH CHECK IC9, R44, SW4-B ON GENERATOR & WIRING FROM E23 ON GENERATOR TO E34 ON TRIG/PULSE
YES
SET FUNCTION TO PULSE
11
*NORMAL/DOUBLE/DELAY SWITCH TO NORMAL, FREQ VERNIER TO CAL, DIAL TO 2.0, ALL OTHERS TO 12 O'CLOCK

Figure 6-8. Pulse Mode Checks, Trig/Pulse Board (Page 1 of 2)

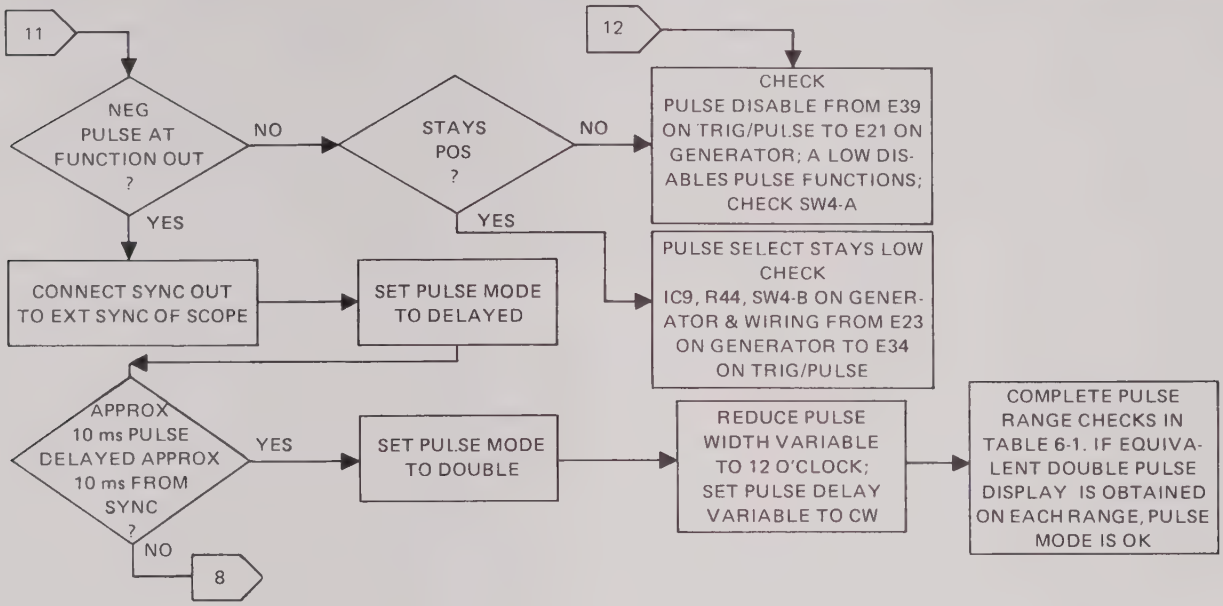

11
NEG PULSE AT FUNCTION OUT ?
NO
YES
CONNECT SYNC OUT TO EXT SYNC OF SCOPE
SET PULSE MODE TO DELAYED
APPROX 10 ms PULSE DELAYED APPROX 10 ms FROM SYNC ?
YES
SET PULSE MODE TO DOUBLE
NO
8
12
STAYS POS ?
NO
YES
CHECK PULSE DISABLE FROM E39 ON TRIG/PULSE TO E21 ON GENERATOR; A LOW DISABLES PULSE FUNCTIONS; CHECK SW4-A
PULSE SELECT STAYS LOW CHECK IC9, R44, SW4-B ON GENERATOR & WIRING FROM E23 ON GENERATOR TO E34 ON TRIG/PULSE
REDUCE PULSE WIDTH VARIABLE TO 12 O'CLOCK; SET PULSE DELAY VARIABLE TO CW
COMPLETE PULSE RANGE CHECKS IN TABLE 6-1. IF EQUIVALENT DOUBLE PULSE DISPLAY IS OBTAINED ON EACH RANGE, PULSE MODE IS OK

Figure 6-8. Pulse Mode Checks, Trig/Pulse Board (Page 2 of 2)

Table 6-1. Pulse Ranges

Pulse Width	Ranging Components	Pulse Delay	Ranging Components	Pulse Period	Scope Horizontal
OFF	IC5, SW3-A	NA	NA	NA	NA
25 ns ▮ 100 ns	C55, Q19, Q20, SW3-B	50 ns ▮ 100 ns	C40, Q16, Q17, SW2-B	> 0.5 μs	0.05 μs/div
100 ns ▮ 1 μs	C56, CR29, CR30	100 ns ▮ 1 μs	C41, CR19, CR20	> 5 μs	0.5 μs/div
1 μs ▮ 10 μs	C57, CR31, CR32	1 μs ▮ 10 μs	C42, CR21, CR22	> 50 μs	5 μs/div
10 μs ▮ 100 μs	C58, CR33, CR34	10 μs ▮ 100 μs	C43, CR23, CR24	> 0.5 ms	50 μs/div
100 μs ▮ 1 ms	C59, CR35, CR36	100 μs ▮ 1 ms	C44, CR25, CR26	> 5 ms	0.5 ms/div
100 μs ▮ 1 ms	C59, CR35, CR36	1 ms ▮ 10 ms†	C45, CR27, CR28	> 5 ms	0.5 ms/div
⊓⊔	IC4 - IC6, SW3-A	NA	NA	0.5 ms	0.5 ms/div

†Rotate PULSE DELAY VERNIER ccw for proper display

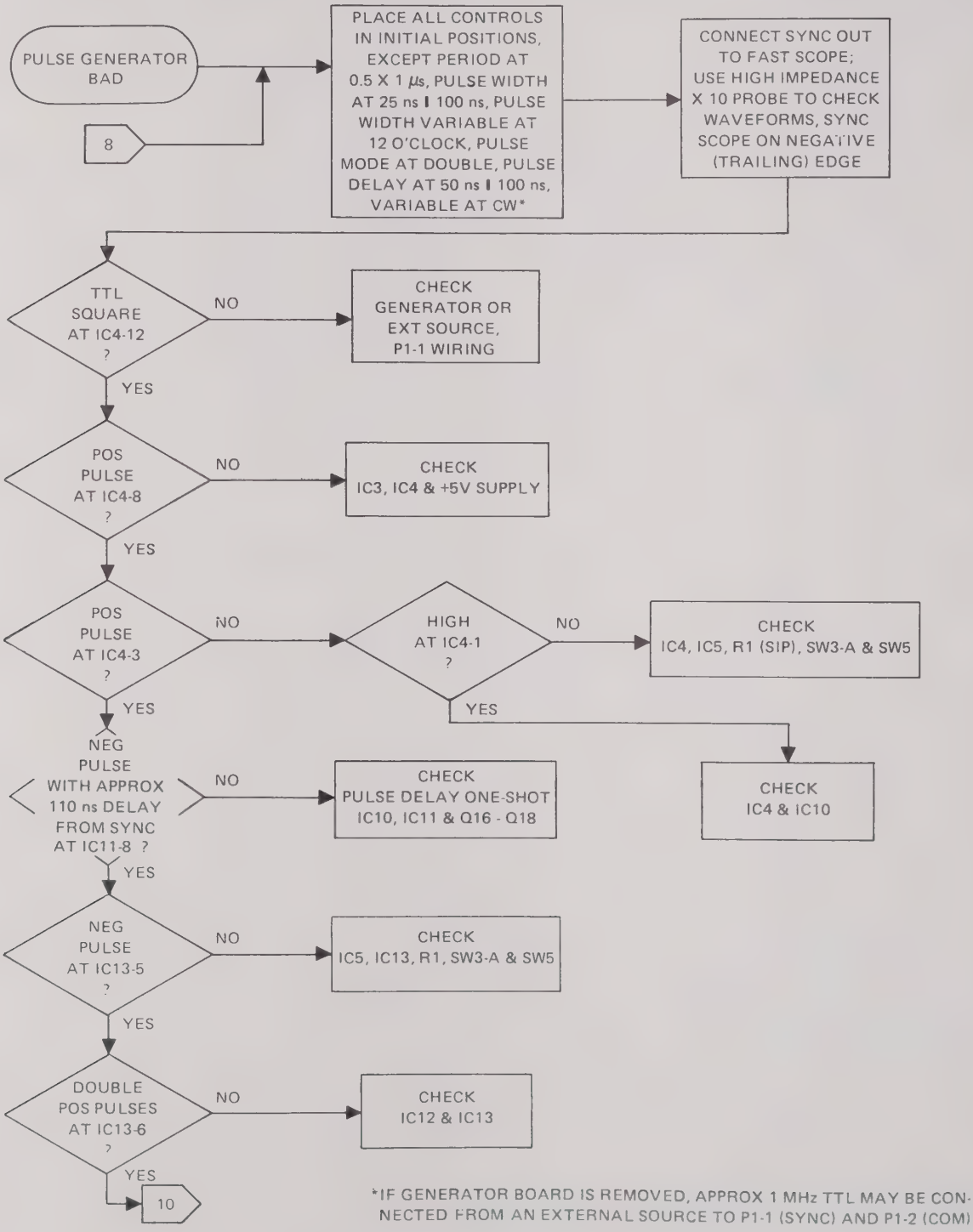

PULSE GENERATOR BAD
8
PLACE ALL CONTROLS IN INITIAL POSITIONS, EXCEPT PERIOD AT 0.5 X 1 μs, PULSE WIDTH AT 25 ns ∎ 100 ns, PULSE WIDTH VARIABLE AT 12 O'CLOCK, PULSE MODE AT DOUBLE, PULSE DELAY AT 50 ns ∎ 100 ns, VARIABLE AT CW*
CONNECT SYNC OUT TO FAST SCOPE; USE HIGH IMPEDANCE X 10 PROBE TO CHECK WAVEFORMS, SYNC SCOPE ON NEGATIVE (TRAILING) EDGE
TTL SQUARE AT IC4-12 ?
NO
CHECK GENERATOR OR EXT SOURCE, P1-1 WIRING
YES
POS PULSE AT IC4-8 ?
NO
CHECK IC3, IC4 & +5V SUPPLY
YES
POS PULSE AT IC4-3 ?
NO
HIGH AT IC4-1 ?
NO
CHECK IC4, IC5, R1 (SIP), SW3-A & SW5
YES
YES
CHECK IC4 & IC10
NEG PULSE WITH APPROX 110 ns DELAY FROM SYNC AT IC11-8 ?
NO
CHECK PULSE DELAY ONE-SHOT IC10, IC11 & Q16 - Q18
YES
NEG PULSE AT IC13-5 ?
NO
CHECK IC5, IC13, R1, SW3-A & SW5
YES
DOUBLE POS PULSES AT IC13-6 ?
NO
CHECK IC12 & IC13
YES
10
*IF GENERATOR BOARD IS REMOVED, APPROX 1 MHz TTL MAY BE CONNECTED FROM AN EXTERNAL SOURCE TO P1-1 (SYNC) AND P1-2 (COM)

Figure 6-9. Pulse Generator Checks, Trig/Pulse Board (Page 1 of 2)

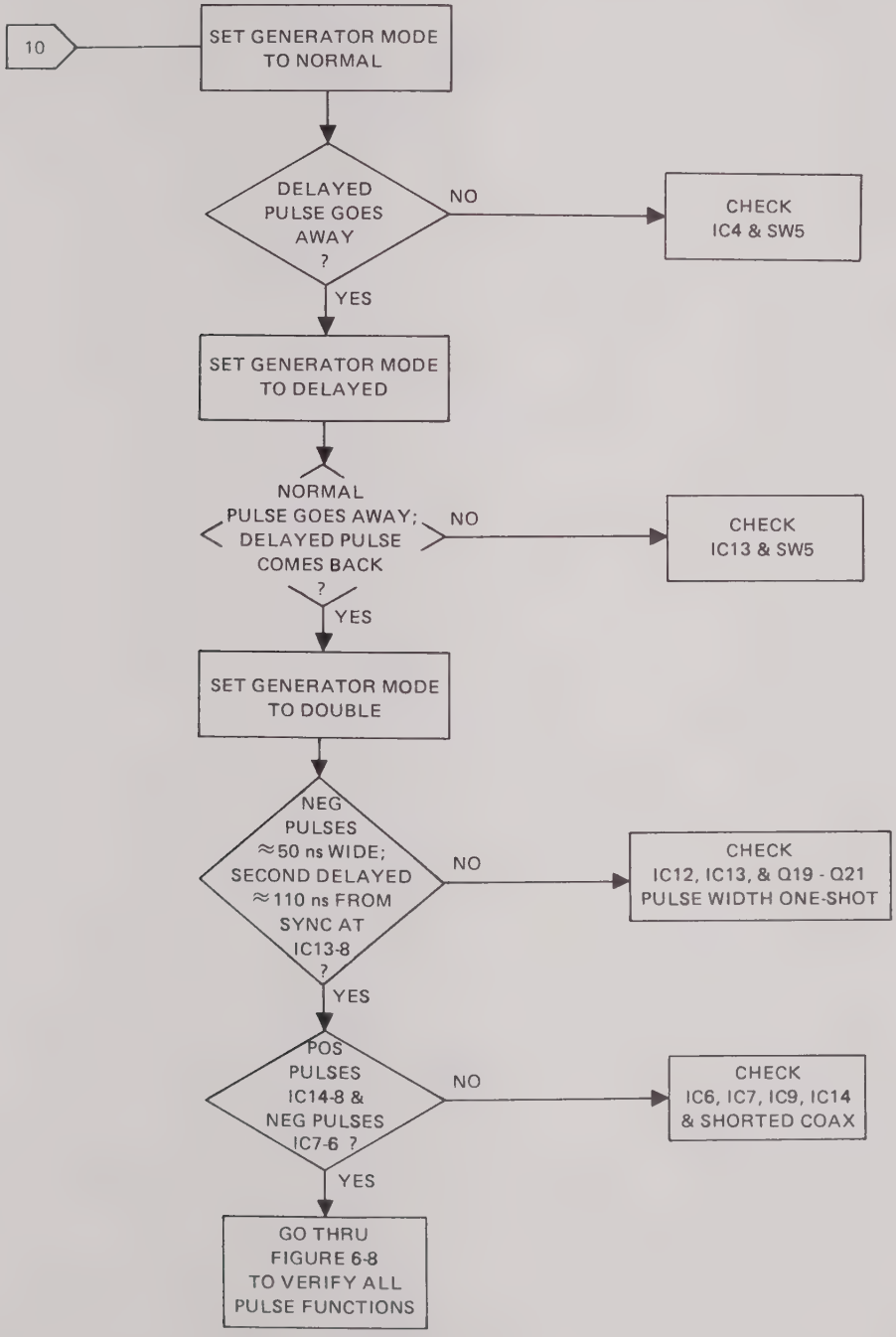

10
SET GENERATOR MODE TO NORMAL
DELAYED PULSE GOES AWAY ?
NO
CHECK IC4 & SW5
YES
SET GENERATOR MODE TO DELAYED
NORMAL PULSE GOES AWAY; DELAYED PULSE COMES BACK ?
NO
CHECK IC13 & SW5
YES
SET GENERATOR MODE TO DOUBLE
NEG PULSES ≈50 ns WIDE; SECOND DELAYED ≈110 ns FROM SYNC AT IC13-8 ?
NO
CHECK IC12, IC13, & Q19 - Q21 PULSE WIDTH ONE-SHOT
YES
POS PULSES IC14-8 & NEG PULSES IC7-6 ?
NO
CHECK IC6, IC7, IC9, IC14 & SHORTED COAX
YES
GO THRU FIGURE 6-8 TO VERIFY ALL PULSE FUNCTIONS

Figure 6-9. Pulse Generator Checks, Trig/Pulse Board (Page 2 of 2)

SECTION 7
PARTS AND SCHEMATICS

7.1 DRAWINGS

The following assembly drawings, schematics and parts lists are in the arrangement shown below.

Drawings	Drawing No.
MODEL 145	
Parts Locator Drawing	0102-00-0101
Parts List	1000-00-0101
CHASSIS	
Assembly Drawing	0102-00-0575
Schematic	0004-00-0101
Parts List	1101-00-0575
GENERATOR BOARD	
Parts Locator Drawing	0100-00-0556
Assembly Drawing (Sheet 2 and 3)	0101-00-0556
Schematic	0103-00-0556
Parts List	1100-00-0556
TRIG/PULSE BOARD	
Parts Locator Drawing	0100-00-0565
Assembly Drawing (Sheet 2)	0101-00-0565
Schematic	0103-00-0565
Parts List	1100-00-0565
TIMER	
Installation and Parts List	0102-00-0221
Parts List	1000-00-0221
RACK MOUNT	
Assembly Drawing	0102-00-0621
Parts List	1101-00-0621
ASSEMBLY HARDWARE	Table 7-1

7.2 ORDERING PARTS

When ordering spare parts, please specify part number, circuit reference, next higher assembly and serial number of unit.

7.3 ADDENDA

Under Wavetek's product improvement program, the latest electronic designs and circuits are incorporated into each Wavetek instrument as quickly as development and testing permit. Because of the time needed to compose and print instruction manuals, it is not always possible to include the most recent changes in the initial printing. Whenever this occurs, addendum pages are prepared to summarize the changes made and are inserted immediately inside the rear cover. If no such pages exist, the manual is correct as printed.

7.4 INDEX OF FEDERAL SUPPLY CODES

The following table gives the Federal Supply Code for Manufacturers (FSCM) for manufacturers cited in the parts lists.

MFGR Code	Manufacturer	FSCM
AMP	AMP Inc. P.O. Box 3608 Harrisburg, PA 17105	00779
ANDEV	Analog Devices Inc. 221 Fifth Street Cambridge, MA 02142	24355
ARCO	Arco Electronics Inc. Community Drive Great Neck, NY 11022	84171
BECK	Beckman Instrument Inc. 2500 Harbor Blvd. Fullerton, CA 92634	71738
BOURN	Bourns Inc. 1200 Columbia Ave. Riverside, CA 92507	32997
C&K	C&K Components Inc. 103 Morse Street Newton, MA 02158	09353
CRL	Centralab-Division of Globe Union Milwaukee, WI 53201	71590
CHIM	Chicago Miniature Lamp Works 4433 Ravenwoods Ave. Chicago, IL 60640	71744
CINCH	Cinch Manufacturing Co. 1026 S. Homan Street Chicago, IL 60624	71785
CRL	Centralab-Division of Globe Union P.O. Box 591 Milwaukee, WI 53201	71590
CORCM	Corman Inc 2635 N. Kildars Ave. Chicago, IL 60639	05245
CTS	CTS Corporation Elkhart, IN 46514	71450
FAIR	Fairchild Semiconductor Division 313 Frontage Road Mountain View, CA 94043	07263
FERRX	Ferroxcube Corporation of America Mount Marion Road Saugerties, NY 12477	02114
GAVTT	Gavitt Wire & Cable 455 N. Quince Street Escondido, CA 92025	23499
IMB	IMB 15401 S. Carments Rd Santa Fe Springs, CA 90670	27556
KING	Kings Electronics Co. Inc 40 Marbledale Road Tuckahoe, NY 11223	91836
LITFU	Littelfuse Inc. 800 E. Northwest Highway Des Plaines, IL 60016	79515
MAL	Mallory Capacitor Co. 3029 E. Washington St. P.O. Box 372 Indianapolis, IN 46206	90201
METRS	Milton Ross Company 511 Second St. Pike Southhampton, PA 18966	07047
MICRO	Micro Semiconductor Corporation 11250 Playa Court Culver City, CA 90230	14552
MOLEX	Molex Products Co. 5224 Katrine Avenue Docuners Grove, IL 60515	27264
MOT	Motorola Inc. Semiconductor Production Div 5005 East McDowell Rd. Phoenix, AZ 85008	04713
PACRD	Packard Electric Division 408 Dana Street N.E. Warren, OH 44481	77060
RCA	RCA Harrison, NJ 07029	86684
ROGAN	Rogan Bros., Inc. 8031 N. Monticello St. Skokie, IL 60076	86797
SEMTEC	Semitech Corporation 652 Mitchell Road Newbury Park, CA 91320	14099
SMITH	Herman H. Smith 812 Snediker Avenue Brooklyn, NY 11207	83330
SPRAG	Sprage Electric Co. North Adams, MA 01247	56289
STKPL	Stackpole Components P.O. Box 14466 Raleigh, NC 27610	29604
THOMN	Thompson Industries Inc. 1029 Plandome Road Manhasset, NY 11030	96881
TI	Texas Instruments North Central Exprwy Dallas, TX 75231	01295
TRIKO	Trico Products Corp. 817 Washington Street Buffalo, NY 14203	75915
TRW	TRW Electronic Components Division 666 Garland Place Des Plaines, IL 60016	18486
UNICP	Unicorp	44729
USECO	USECO Inc. Mt. Vernon, NY	15849
WVTK	Wavetek 9045 Balboa Avenue San Diego, CA 92123	23338

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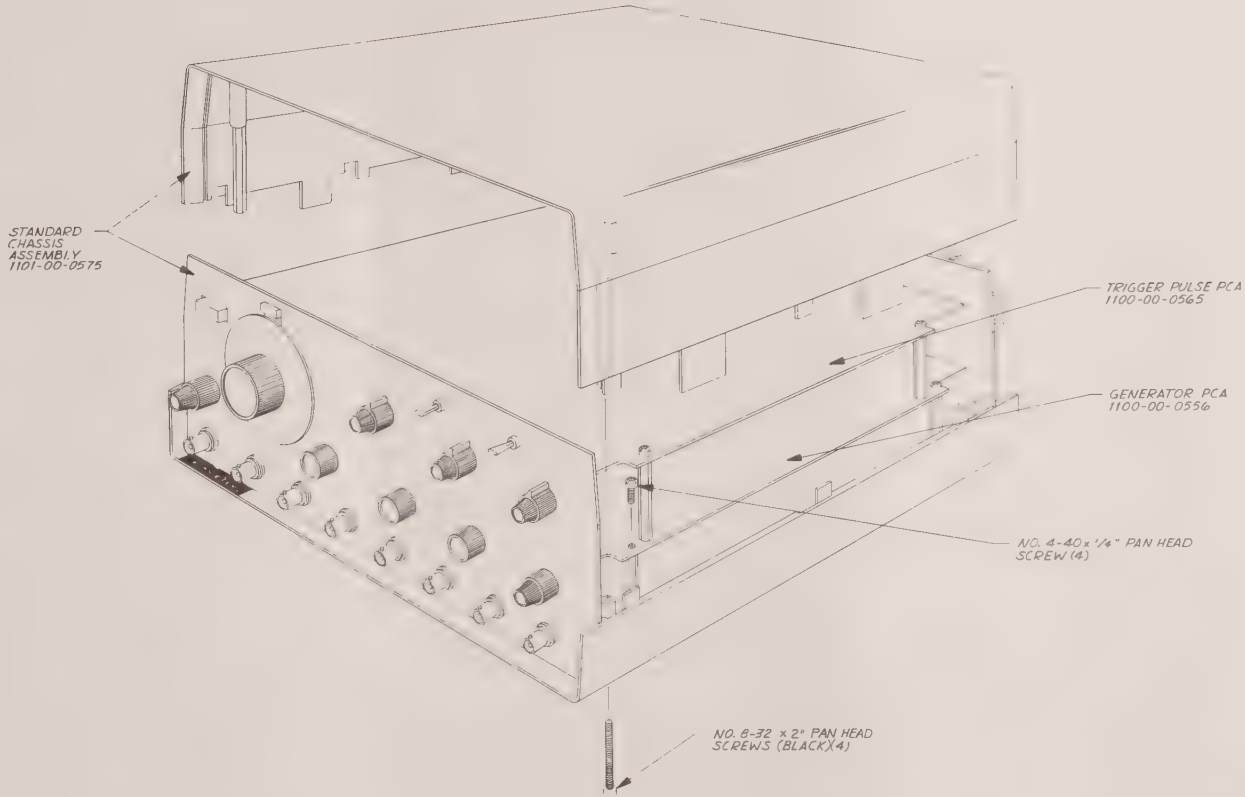
STANDARD CHASSIS ASSEMBLY 1101-00-0575
TRIGGER PULSE PCA 1100-00-0565
GENERATOR PCA 1100-00-0556
NO. 4-40 x 1/4" PAN HEAD SCREW (4)
NO. 8-32 x 2" PAN HEAD SCREWS (BLACK X 4)

REV	ITEM	BY	DATE	APP
	40-53, 40-49 III, AFT 1/4, 10-11-...			

ITEM TOLERANCES ARE BREAK SHARP EDGES	DRAWN D. COOPER	DATE 11.8.89	WAVETEK SAN DIEGO, CALIFORNIA
MATERIAL	PRO. ENGR		TITLE ASSEMBLY MODEL 145
FINISH WAVETEK PROCESS	RELEASE APPROV		
	TOLERANCE UNLESS OTHERWISE SPECIFIED .XXX = .010 ANGLES ± .XX = .030		
	DO NOT SCALE DWG		MODEL NO 145 / DWG NO 0102-00-0101 / REV
	SCALE —		CODE IDENT 23338 / SHEET 1 OF 1

0102-00-0101

NOTE UNLESS OTHERWISE SPECIFIED

BISHOP GRAPHICS ACCURPRESS RECORDER NO. X-9861

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REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO	QTY/PT
NONE	SCHEMATIC, INSTRUMENT	0004-00-0101	WVTK	0004-00-0101	1
NONE	FINAL CAL PROCEEDURE	0006-00-0101	WVTK	0006-00-0101	1
NONE	QA PROCEEDURE	0007-00-0101	WVTK	0007-00-0101	1
NONE	ASSY DRWG, MODEL 145	0102-00-0101	WVTK	0102-00-0101	1
NONE	PCA, GENERATOR	145-556	WVTK	1100-00-0556	1
NONE	PCA, TRIGGER/PULSE	145-565	WVTK	1100-00-0565	1
NONE	STD CHASSIS	145-575	WVTK	1101-00-0575	1
NONE	INSERT	101-7	WVTK	3300-00-0003	1
NONE	CARTON	101-7A	WVTK	3300-01-0003	1
NONE	INSTRUCTION MANUAL	MANUAL-145	WVTK	1300-00-0101	1

WAVETEK PARTS LIST

TITLE: MODEL 145 20MHZ PULSE FUNCTION GENERATOR

ASSEMBLY NO: 1000-00-0101

REV: Y

PAGE 1

REMOVE ALL BURRS AND BREAK SHARP EDGES

MATERIAL

FINISH WAVETEK PROCESS

DRAWN

DATE

PROTNOR

RELEASE APPROVAL

TOLERANCE UNLESS OTHERWISE SPECIFIED .XXX ± .010 ANGLES ± 1 .XX ± .03

DO NOT SCALE DWG

SCALE

WAVETEK SAN DIEGO, CALIFORNIA

TITLE: PARTS LIST 20 MHz PULSE/FUNCTION GENERATOR/145

MODEL NO: 145

DWG NO: 1000-00-0101

REV: Y

CODE IDENT: 23338

SHEET 1 OF 1

NOTE UNLESS OTHERWISE SPECIFIED

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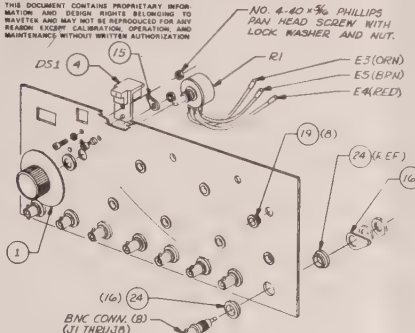
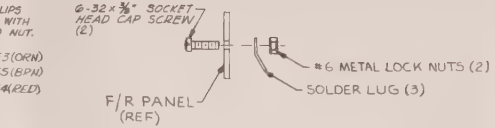
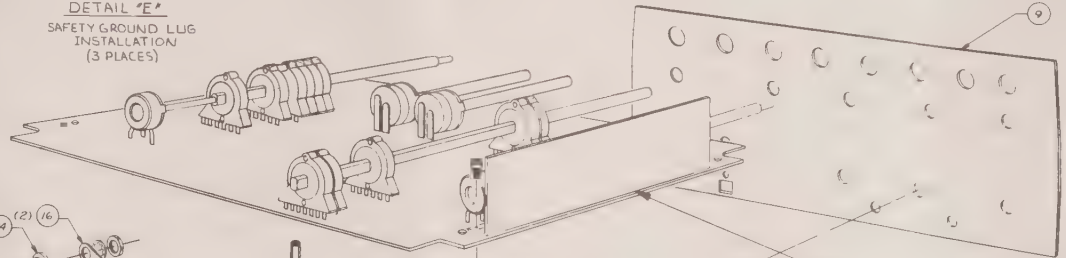
NOTES:
ALL CONNECTIONS TO BE MECHANICALLY SECURE PRIOR TO SOLDERING GROUND WIRES.

REV	E N	BY	APP	APP
B	ECN 1806	RM		
J	ECN 2691			

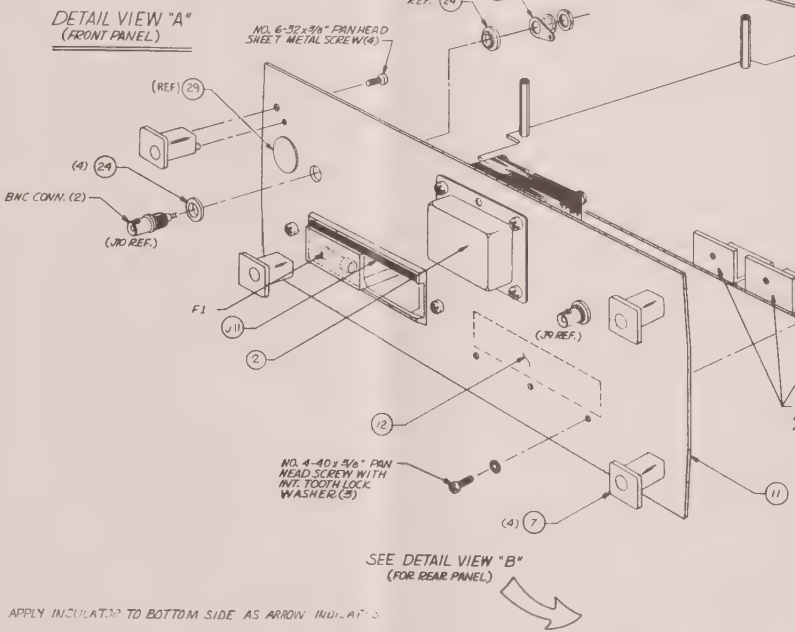

NO. 4-40 x 3/16 PHILLIPS PAN HEAD SCREW WITH LOCK WASHER AND NUT.
DS1
R1
E3(ORN)
E5(BRN)
E4(RED)
BNC CONN. (8) (J1 THRU J8)
FOR BNC WIRING SEE SHT 2 DETAIL VIEW "C"



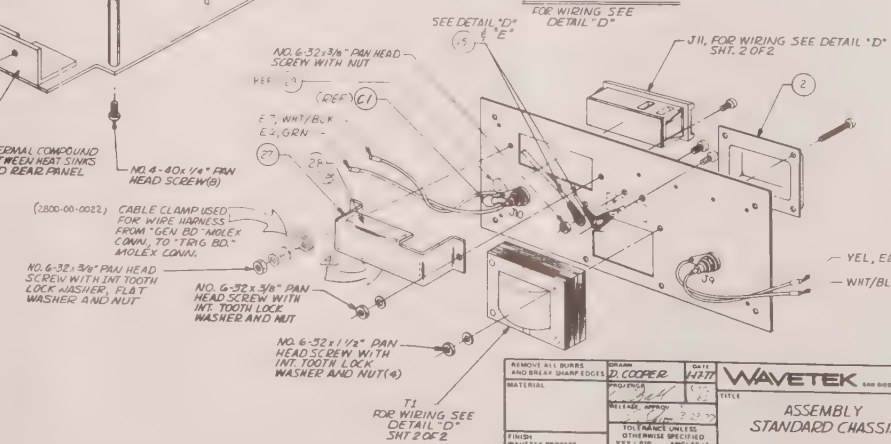
DETAIL "E"
SAFETY GROUND LUG INSTALLATION (3 PLACES)



DETAIL VIEW "A" (FRONT PANEL)


NO. 6-32 x 3/8" PAN HEAD SHEET METAL SCREW (4)
BNC CONN. (2)
(J10 REF.)
F1
J11
(J9 REF.)
THERMAL COMPOUND BETWEEN HEAT SINKS AND REAR PANEL
NO. 4-40 x 1/4" PAN HEAD SCREW (8)
NO. 4-40 x 3/8" PAN HEAD SCREW WITH INT. TOOTH LOCK WASHER (3)
SEE DETAIL VIEW "B" (FOR REAR PANEL)

DETAIL VIEW "B"
REAR PANEL
FOR WIRING SEE DETAIL "D"


SEE DETAIL "D" "E"
J11, FOR WIRING SEE DETAIL "D" SHT. 2 OF 2
NO. 6-32 x 3/8" PAN HEAD SCREW WITH NUT
E7, WHT/BLK
E4, GRN
(2800-00-0022) CABLE CLAMP USED FOR WIRE HARNESS FROM "GEN BD" MOLEX CONN., TO "TRIG BD." MOLEX CONN.
NO. 6-32 x 3/8" PAN HEAD SCREW WITH INT TOOTH LOCK WASHER, FLAT WASHER AND NUT
NO. 6-32 x 3/8" PAN HEAD SCREW WITH INT. TOOTH LOCK WASHER AND NUT
NO. 6-32 x 1 1/2" PAN HEAD SCREW WITH INT. TOOTH LOCK WASHER AND NUT (4)
T1 FOR WIRING SEE DETAIL "D" SHT 2 OF 2
YEL, E26
WHT/BLK, E27

⚠2 APPLY INSULATOR TO BOTTOM SIDE AS ARROW INDICATES

⚠3 INSTALL ITEM 28 USING DOW CORNING RTV 3140 TO COVER THEN APPLY INSULATOR. SEE ⚠4

NOTE UNLESS OTHERWISE SPECIFIED

REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN D. COPPER	DATE 4/27/77	WAVETEK SAN DIEGO, CALIFORNIA
MATERIAL	ENGINEER		TITLE ASSEMBLY STANDARD CHASSIS
FINISH WAVETEK PROCESS	RELEASE APPROV		
	TOLERANCE UNLESS OTHERWISE SPECIFIED XXX ± .010 ANGLES ± 1° XX ± .030		
	DO NOT SCALE DWG		MODEL NO 145
	SCALE		DWG NO 0102-00-0575 REV J
			CODE IDENT 23330 SHEET 1 OF 2

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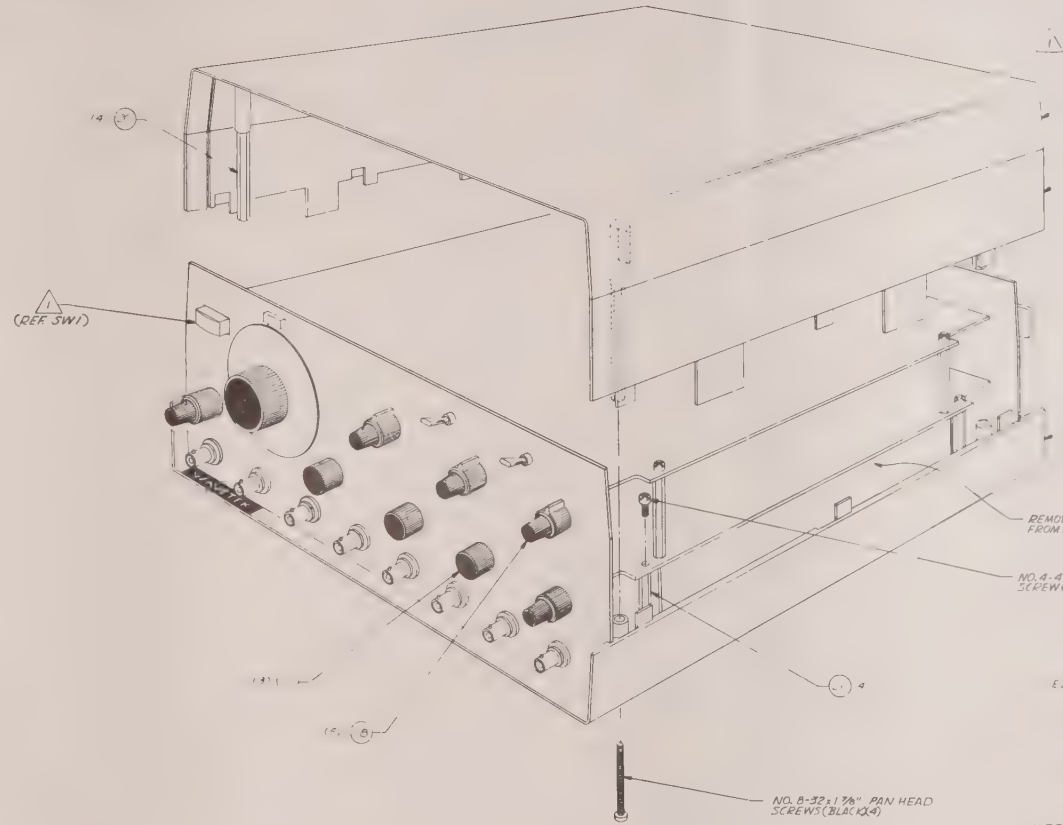
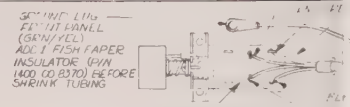
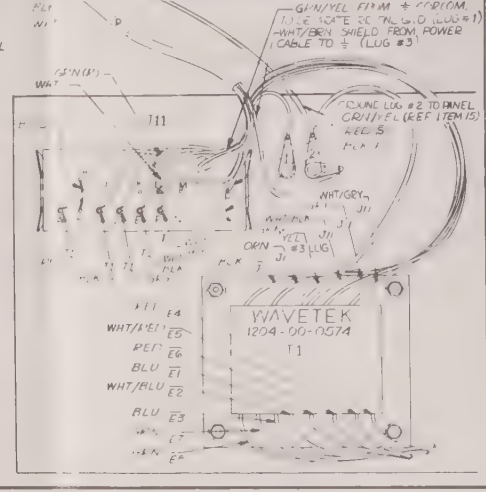


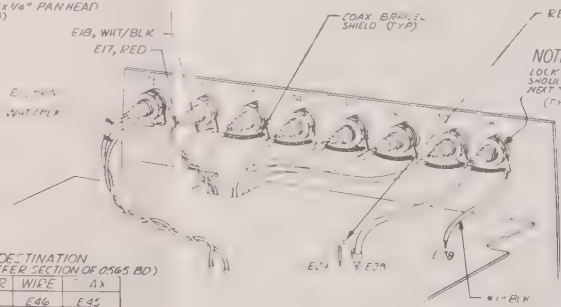


1 POWER SWITCH DETAIL (SW1)

DETAIL VIEW "D"
REAR PANEL WIRING



DETAIL VIEW "C"
BNC CONN. WIRING, FRONT PANEL



WIRE DESTINATION
(OUTPUT BUFFER SECTION OF 0565 BD)

FROM	WIRE COLOR	WIRE	Ax
J3	WHT/ORN	E46	E45
J4	WHT/YEL	E47	E44
J5	WHT/GRN	E48	E43
J6	WHT/BLU	E41	E40
J7	WHT/VIO	E31	E30

2 CEMENT ITEM 6(2) TO ITEM 5 (TYP BOTH SIDES)

1 MOUNT SWITCH TO P.C. BOARD PRIOR TO INSTALLING FRONT PANEL, USE NO. 2-56 x 1/4" PAN HEAD SCREW WITH NUT (2)

NOTE UNLESS OTHERWISE SPECIFIED

REMOVE ALL BURRS AND BREAK SHARP EDGES
MATERIAL
FINISH WAVETEK PROCESS
DRAWN D.COOPER 10-17
TOLERANCE UNLESS OTHERWISE SPECIFIED ANGLES ± 1 .XX ± .010 .XXX ± .005
DO NOT SCALE DWG
SCALE

WAVETEK SAN DIEGO, CA

ASSEMBLY
STANDARD CHASSIS

MODEL NO 145
DWG NO 0102-00-0575
REV J
CODE IDENT 23338
SHEET 2 OF 2

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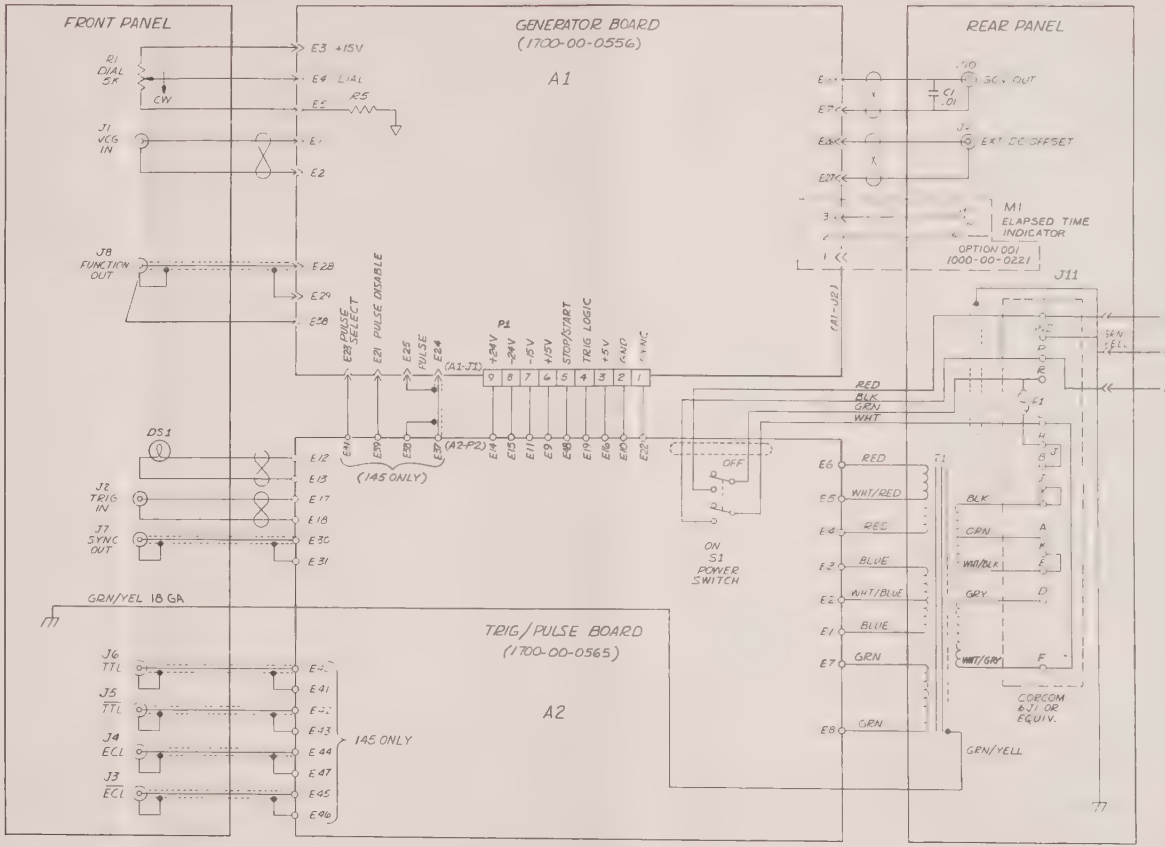
REV	ECN	BY	DATE	APP
B	ECN 1800	JRM	9 5 8	
C	ECN 1801	JRM	9 6 8	
D	ECN 2123 AUDIT	DJW	5-11-81	
E	ECN 3881	FN	8/1/86	



3/16A 220-240 VAC
1. F1 - 3/6A 100-120 VAC

NOTE UNLESS OTHERWISE SPECIFIED

REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN J. COOPER	DATE 11976	WAVETEK SAN DIEGO, CALIFORNIA
MATERIAL	APPROVED		TITLE INSTRUMENT SCHEMATIC
FINISH WAVETEK PROCESS	RELEASE APPROVAL		
	TOLERANCES UNLESS OTHERWISE SPECIFIED XXX .010 ANGLES 1 XX .030		
	DO NOT SCALE DWG		MODEL NO 143/145 DWG NO 0004-00-0101 REV E
			CODE IDENT 23338 SHT 1 OF 1

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REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
NONE	ASSY DRWG CHASSIS	0102-00-0575	WVTK	1102-00-0575	
1	DIAL ASSY	801-577	WVTK	1251-00-0577	
T1	TRANSFORMER	143-574	WVTK	1204-00-0574	
2	KND BELL	110-333	WVTK	1400-00-0174	
NONE	PLATE NAME	139-305	WVTK	1400-00-2180	
4	INDICATOR DIAL	180-303	WVTK	1400-00-4970	
NONE	COVER TOP	180-300-1	WVTK	1400-00-5000	
5	EXPANDER	180-301	WVTK	1400-00-5010	
6	POST	180-302	WVTK	1400-00-5020	
NONE	COVER BOTTOM	180-300-2	WVTK	1400-00-5030	
27	SHIELD PWR	1400-00-6210	WVTK	1400-00-6210	
14	PANEL REAR	1400-00-6760	WVTK	[illegible]	
9	PANEL FRONT	1400-00-6770	WVTK	[illegible]	
NONE	INSULATOR,PWR SWITCH REF 1600-99-0001	1400-00-8370	WVTK	1400-00-8370	
12	I.D. LABEL	1400-00-9090	WVTK	1400-00-9090	
28	INSULATOR PLATE REF 3200-03-0004	1400-01-3931	WVTK	1400-01-3931	
3	CAP CER MN .01MF 50V	CAC0225U103Z100A	TORNG	1400-01-0310	

WAVETEK PARTS LIST — TITLE: CHASSIS — ASSEMBLY NO: 1101-00-0575 — PAGE 1 — REV: K

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
J1 J1C J2 J3 J4 J5 J6 J7 J8 J9	BNC CONN	KC-7946	KING	2100-01-0002	
J11	RECEPTACLE	6VJ1	CORCH	2100-03-0026	
16	SOLDER LUG	1493	SMITH	2100-04-0012	
15	SOLDER LUG	1485-6	SMITH	2100-04-0025	
17	STD KNOB	RB-67-1-SB-M	ROGAN	2100-01-0008	
18	COAX KNOB SET	RB-67-1-SB-0-M-9	ROGAN	2400-01-0009	
DS1	.AMP	7B76	JKL	2400-02-0013	
F1	FUSE 1/2A 250V	313.500	LITFU	2400-05-0010	
NONE	CLAMP CABLE	933	SMITH	2800-00-0022	
19	BUSHING NYLINER	4L2FF	THOMA	2800-01-0002	
21	STANDOFF MALE/FEMALE 1.750 H .250 HEX 6-32	1493-M03-F05-832	UNICP	2800-02-0010	
21	STANDOFF MALE/FEMALE 2.375 H..250 HEX 4 40	1493-M03-F05-440	UNICP	2800-02-0011	
NONE	BAIL ASSY W/FT	180-500	WVTK	2800-08-0010	
NONE	SPEEDNUT SELF RETAIN	C7494-632-4	TINN	2800-09-0003	
24	WASHER,SHOULDER	266B	SMITH	2800-27-0004	

WAVETEK PARTS LIST — TITLE: CHASSIS — ASSEMBLY NO: 1101-00-0575 — PAGE 2 — REV: K

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
25	PLUG BUTTON	266J BLACK	HEYCO	2800-35-0004	
S1	SWITCH ASSY PB	5102-00-0008	WVTK	5102-00-0008	
W1PW	WIRE HU 14GA	14GA-BLACK	PANDU	6000-31-6000	
W1BR	WIRE HU 22GA	15U-BROWN	GAUTT	6000-32-2001	
W1RD	WIRE HU 22GA	15U-RED	GAUTT	6000-32-2002	
W1OR	WIRE,HU 22GA	15U-ORANGE	GAUTT	6000-32-2003	
W1YL	WIRE HU 22GA	15U-YELLOW	GAUTT	6000-32-2004	
W1GN	WIRE HU 22GA	15U-GREEN	GAUTT	6000-32-2005	
W1WH	WIRE HU 22GA	15U-WHITE/BLACK	GAUTT	6000-32-2006	
W2	CABLE COAX 26AWG	RG 174/U	ITT	6001-40-0001	
W3	CABLE 4 COND 20GA	8722	BELDN	6001-70-0007	
W4	PWR CORD	6001-80-0003	WVTK	6001-80-0003	

WAVETEK PARTS LIST — TITLE: CHASSIS — ASSEMBLY NO: 1101-00-0575 — PAGE 3 — REV: K

NOTE: UNLESS OTHERWISE SPECIFIED

REMOVE ALL BURRS AND BREAK SHARP EDGES — MATERIAL — FINISH WAVETEK PROCESS

DRAWN — DATE — FINISHER — RELEASE APPROV.

TOLERANCE UNLESS OTHERWISE SPECIFIED XXX ±.010 ANGLES 1 XX ±.030

DO NOT SCALE DWG — SCALE

WAVETEK SAN DIEGO, CALIFORNIA

TITLE: PARTS LIST STD CHASSIS

MODEL NO: 145 — DWG NO: 1101-00-0575 — REV: K

CODE IDENT: 23338 — SHEET 1 OF 1

BISHOP GRAPHICS/ACCUPRESS

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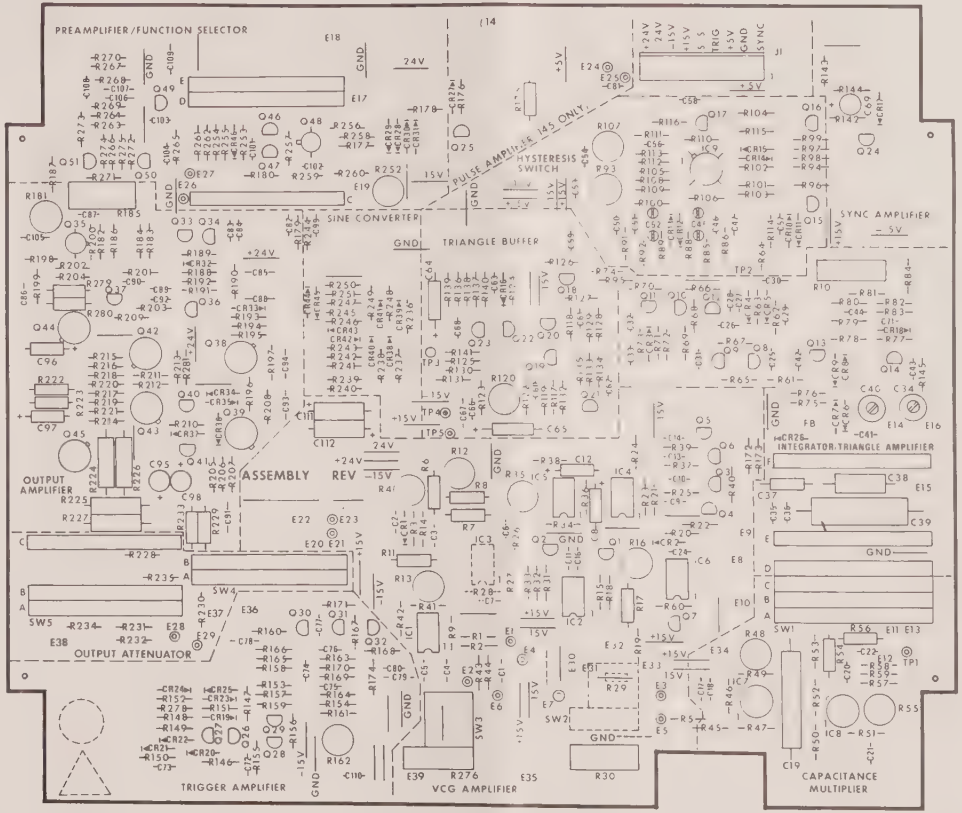

REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN	DATE	WAVETEK	
MATERIAL			TITLE	GENERATOR BOARD PARTS LOCATOR
FINISH WAVETEK PROCESS	TOLERANCE UNLESS OTHERWISE SPECIFIED .XXX .010 ANGLES ± .5° .030			
	DO NOT SCALE DWG.		MODEL NO. 143/145	DWG NO. 0100-00-0556 REV. C
	SCALE		FSCM NO. 23330	SHEET 1 OF 1

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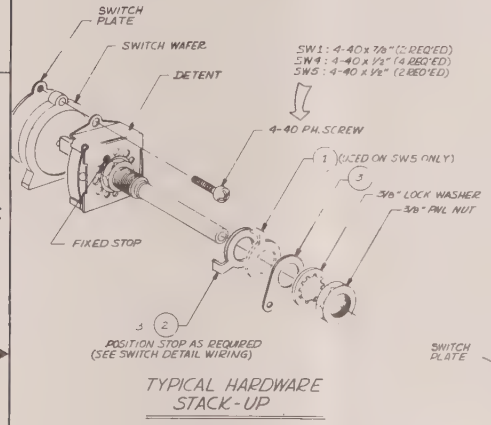
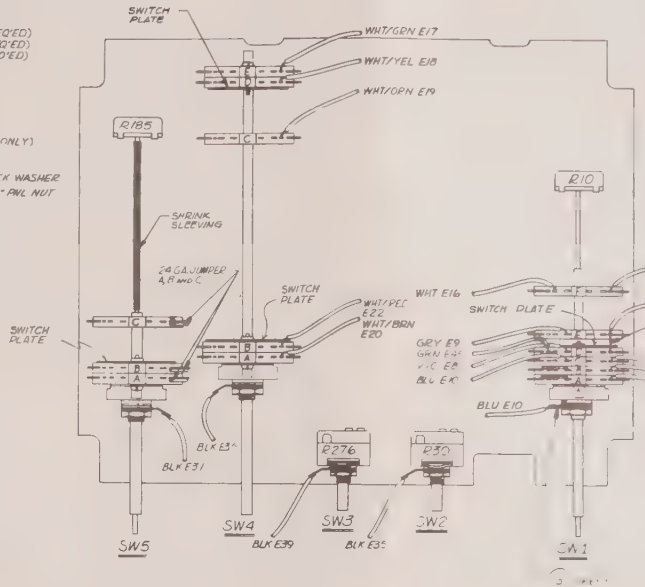
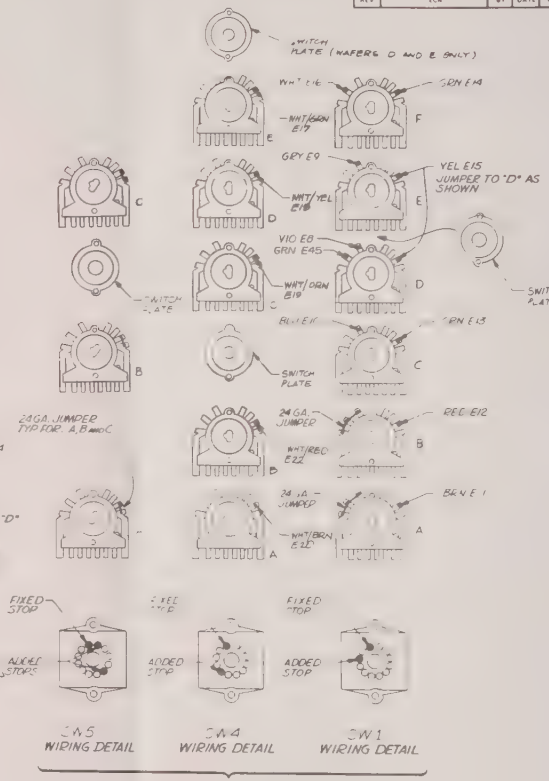


TYPICAL HARDWARE STACK-UP





DETENT SHOWN FROM FRONT VIEW IN FULL COUNTER CLOCKWISE POSSITION

2. SWITCH PLATE P/N 1400-00-2130

1 TURN TO FULL COUNTER CLOCKWISE POSITION THEN TURN BACK CLOCKWISE ONE POSITION TO INSTALL BOTH STOPS

NOTE UNLESS OTHERWISE SPECIFIED

REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN D. COOPER	DATE 4/8/77	WAVETEK SAN DIEGO, CALIFORNIA	
MATERIAL —	CHECKED		TITLE	ASSEMBLY GENERATOR BOARD
FINISH WAVETEK PROCESS —	RELEASED		TOLERANCE UNLESS OTHERWISE SPECIFIED .XXX ± .010 ANGLES ± .XX ± .030	
	DO NOT SCALE DWG		MODEL NO 145	DWG NO 0101-00-0556 REV Q
	SCALE		CODE IDENT 23338	SHEET 2 OF 3

0101-00-0556 Q

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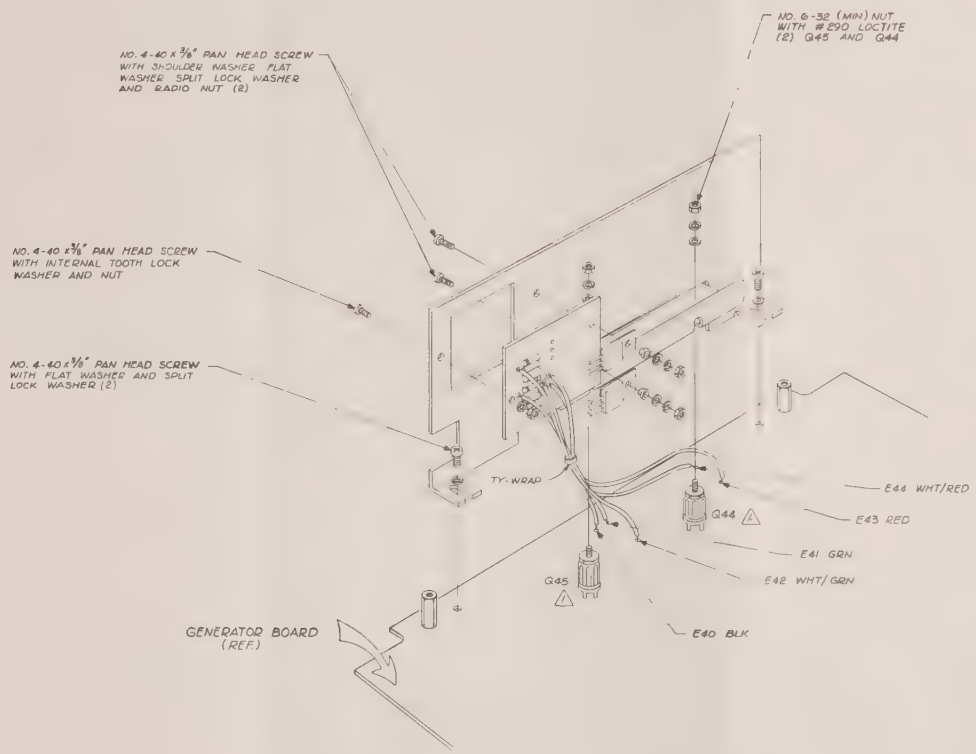
REV	ECN	BY	DATE	APP


NO. 6-32 (MIN) NUT WITH #290 LOCTITE (2) Q45 AND Q44
NO. 4-40 x 3/8" PAN HEAD SCREW WITH SHOULDER WASHER FLAT WASHER SPLIT LOCK WASHER AND RADIO NUT (2)
NO. 4-40 x 3/8" PAN HEAD SCREW WITH INTERNAL TOOTH LOCK WASHER AND NUT
NO. 4-40 x 3/8" PAN HEAD SCREW WITH FLAT WASHER AND SPLIT LOCK WASHER (2)
TY-WRAP
E44 WHT/RED
E43 RED
Q44
E41 GRN
E42 WHT/GRN
Q45
E40 BLK
GENERATOR BOARD (REF.)

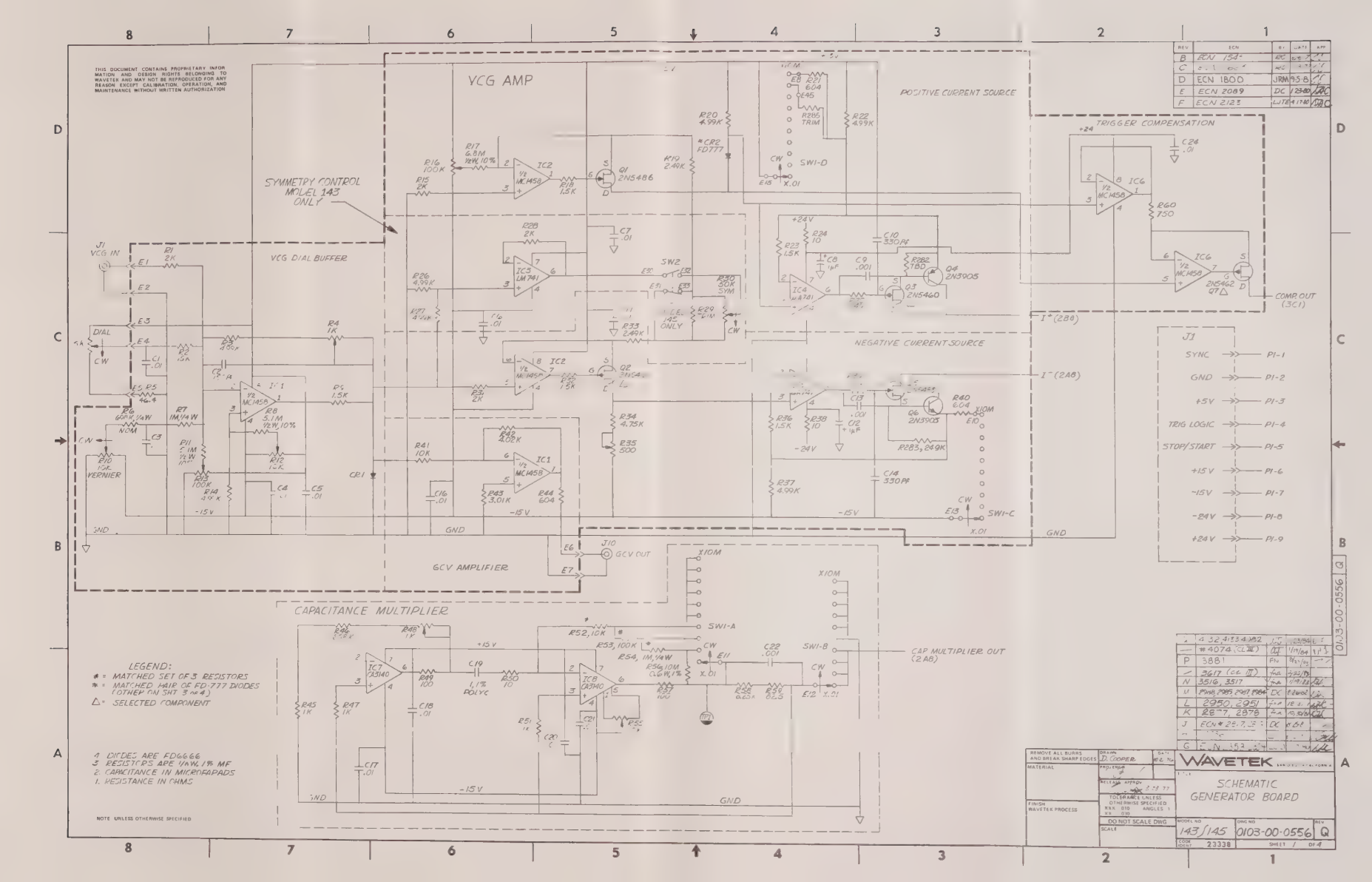
⚠1 USE HEATSINK CLIP NO. 2800-11-0012

NOTE UNLESS OTHERWISE SPECIFIED

REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN F N AQUINO	DATE 6/10/92	WAVETEK SAN DIEGO, CALIFORNIA
MATERIAL	PROJECT		TITLE ASSEMBLY GENERATOR BOARD
FINISH WAVETEK PROCESS	ENG APPROV	6/14/92	
	TOLERANCE UNLESS OTHERWISE SPECIFIED .XXX ± .010 ANGLES ± 1 .XX ± .030		
	DO NOT SCALE DWG		MODEL NO 145 / DWG NO 0101-00-0556 / REV Q
			CODE IDENT 23338 / SHEET 3 OF 3

0101-00-0556 Q

BISHOP GRAPHICS/ACCU-PRESS RECORDER NO. A-3844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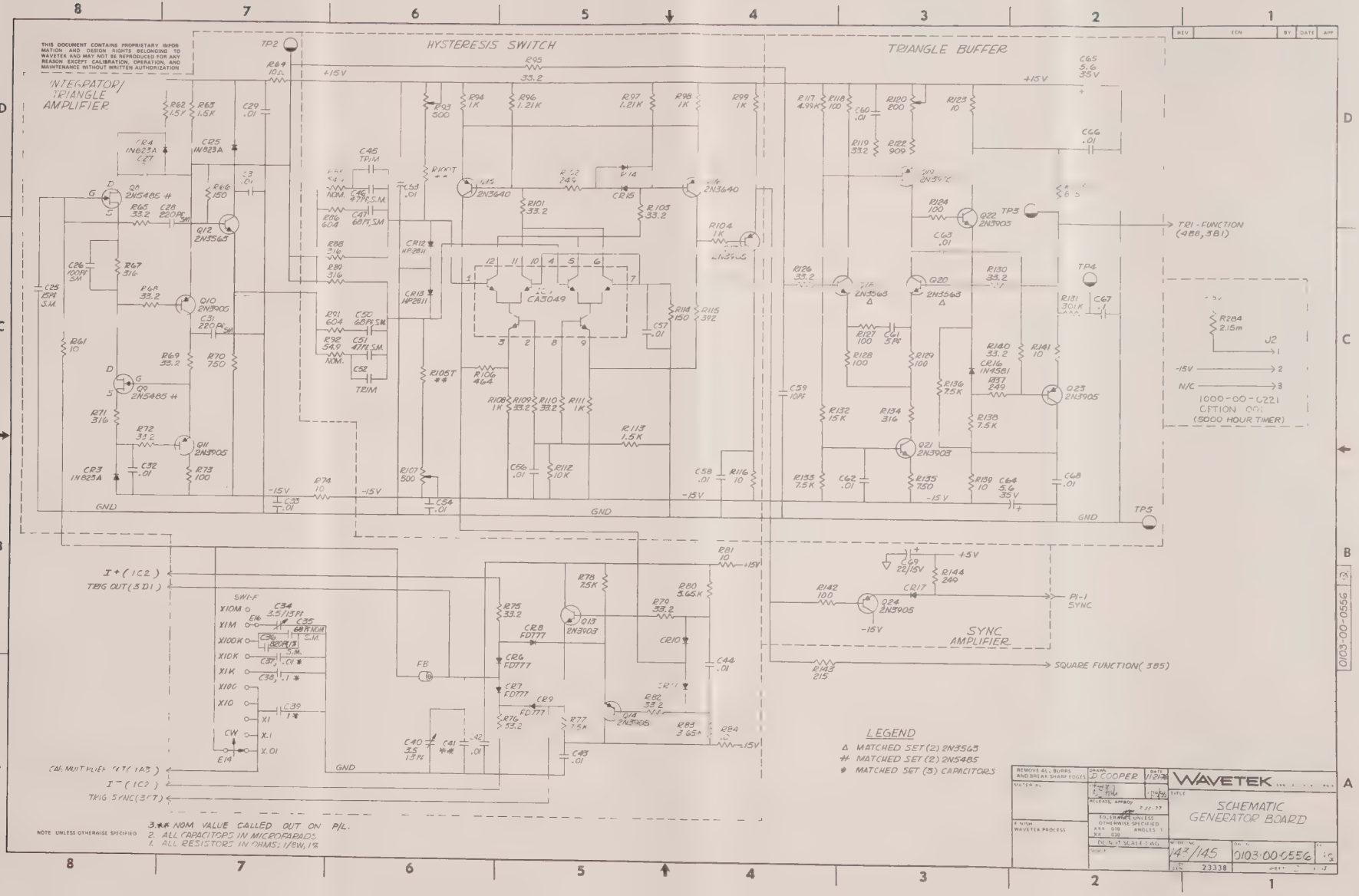
VCG AMP
SYMMETRY CONTROL MODEL 143 ONLY
VCG DIAL BUFFER
POSITIVE CURRENT SOURCE
NEGATIVE CURRENT SOURCE
TRIGGER COMPENSATION
GCV AMPLIFIER
CAPACITANCE MULTIPLIER
J1 VCG IN
DIAL
VERNIER
J10 GCV OUT
CAP MULTIPLIER OUT (2AB)
COMP OUT (3C1)
I+ (2B8)
I- (2A8)
SYNC
GND
+5V
TRIG LOGIC
STOP/START
+15V
-15V
-24V
+24V
LEGEND:
* = MATCHED SET OF 3 RESISTORS
** = MATCHED PAIR OF FD-777 DIODES (OTHER ON SHT 3 ref 4)
△ = SELECTED COMPONENT
1. DIODES ARE FD6666
3. RESISTORS ARE 1/4W, 1% MF.
2. CAPACITANCE IN MICROFARADS
1. RESISTANCE IN OHMS
NOTE UNLESS OTHERWISE SPECIFIED
REV ECN BY DATE APP
B ECN 154- RC 5-8-77
C ECN 1800 JRM 9-5-78
D ECN 1800 JRM 9-5-78
E ECN 2089 DC 12-30-80
F ECN 2123 LJTE 4-17-81
SCHEMATIC GENERATOR BOARD
WAVETEK
MODEL NO 143/145
DWG NO 0103-00-0556
REV Q
SHEET 1 OF 4
0N3-00-0556 Q


HYSTERESIS SWITCH
TRIANGLE BUFFER
INTEGRATOR/ TRIANGLE AMPLIFIER
SYNC AMPLIFIER
+15V
-15V
+5V
GND
TP2
TP3
TP4
TP5
TRI-FUNCTION (488,381)
PI-1 SYNC
SQUARE FUNCTION(385)
1000-00-0221 OPTION 001 (5000 HOUR TIMER)
I+ (IC2)
TRIG OUT(3D1)
I- (IC2)
TRIG SYNC(3F7)
CAL MULTIPLIER OUT(1A3)
CA3049
2N3640
2N3563
2N3903
2N3905
2N5485
LEGEND
Δ MATCHED SET(2) 2N3563
MATCHED SET(2) 2N5485
* MATCHED SET (3) CAPACITORS
NOTE UNLESS OTHERWISE SPECIFIED
3.** NOM VALUE CALLED OUT ON P/L.
2. ALL CAPACITORS IN MICROFARADS.
1. ALL RESISTORS IN OHMS: 1/8W, 1%
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REV ECN BY DATE APP
WAVETEK
SCHEMATIC GENERATOR BOARD
0103-00-0556
142/145
23338

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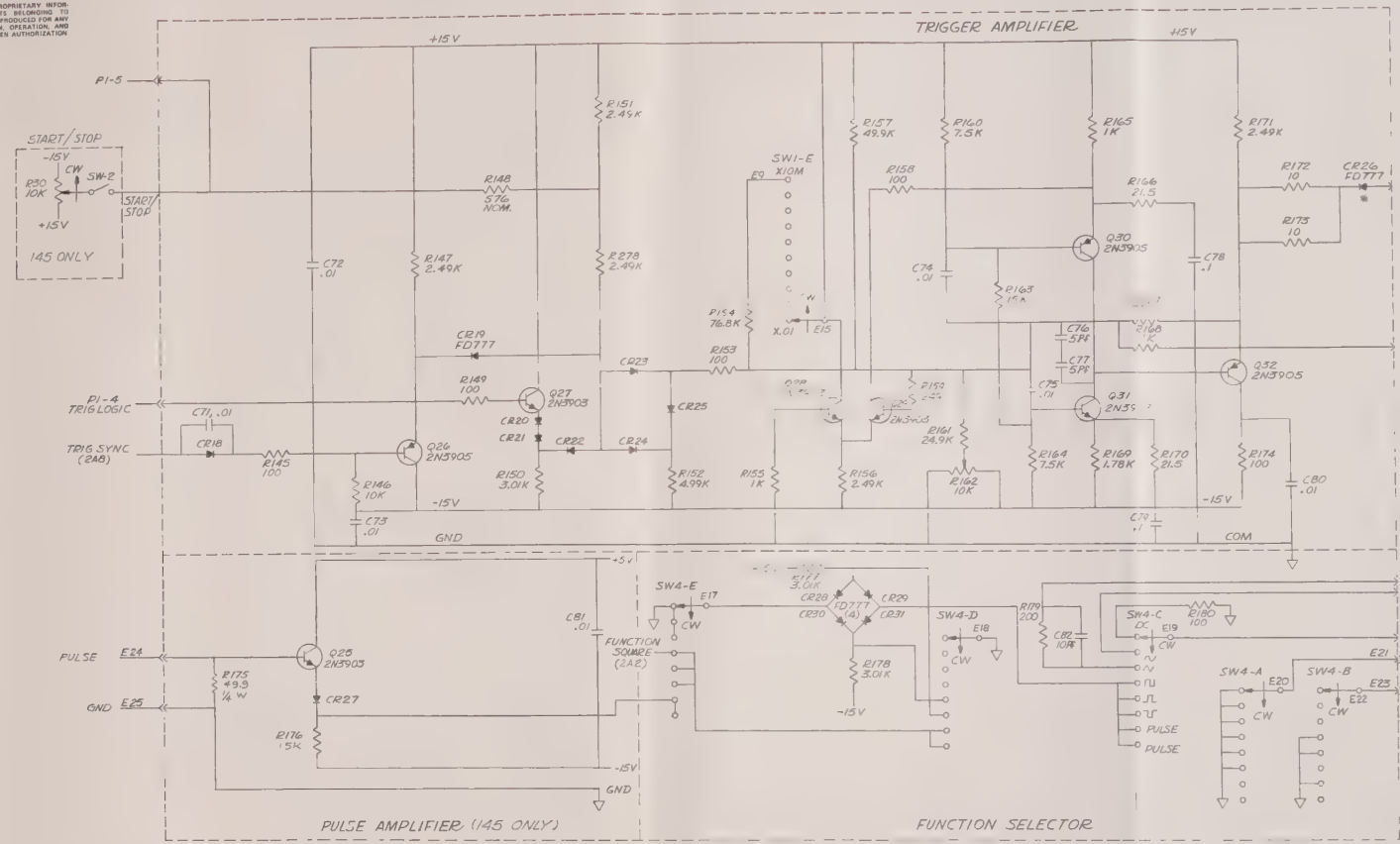

5. DIODES ARE FD6666
4. RESISTORS ARE 1/8W, 1%, MF
3. CAPACITANCE IN MICROFARADS
2. RESISTANCE IN OHMS
1. * MATCHED PAIR OF FD777 (OTHER ON SHT. 1)

NOTE UNLESS OTHERWISE SPECIFIED

REMOVE ALL BURRS AND BREAK SHARP EDGES
MATERIAL
FINISH
WAVETEK PROCESS
DRAWN D. COOPER 1/8/76
ENGINEER
RELEASE SPYDY 3-7-77
TOL. UNLESS OTHERWISE SPECIFIED .XXX .010 ANGLES 1 .XX .020
DO NOT SCALE DRAWING
WAVETEK SAN DIEGO, CALIFORNIA
TITLE SCHEMATIC GENERATOR BOARD
MODEL NO. 143/145
DWG NO. 0103-00-0556
REV. TQ
CUST. NO. 23338
SHEET 3 OF 4
0103-00-0556 Q

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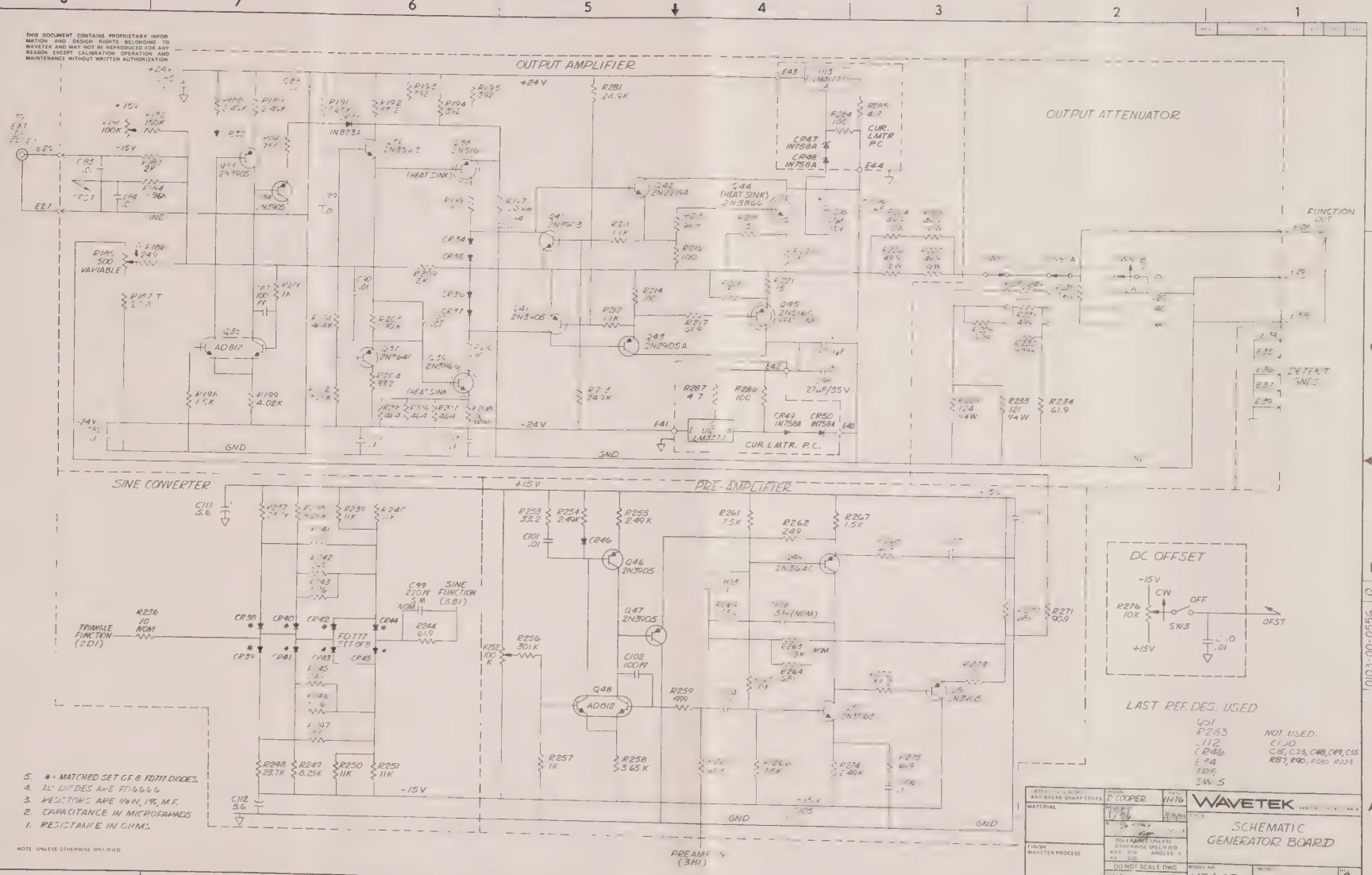

MATERIAL	D. COOPER	WAVETEK	
FINISH WAVETEK PROCESS	DO NOT SCALE DWG	SCHEMATIC GENERATOR BOARD	
	MODEL NO. 143/145	DWG NO. 0103-00-0556	REV. A
	CODE IDENT NO. 23338	SHEET 4 OF 4	

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REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO	QTY/PT
NONE	ASSY DRWG GENERATOR	0101-00-0556	WVTK	0101-00-0556	1
NONE	SCHEMATIC GENERATOR	0103-00-0556	WVTK	0103-00-0556	1
NONE	PCA, CURRENT LIMITER	143-1008	WVTK	1208-00-1008	1
NONE	PLATE, BM	008-004	WVTK	1400-00-2130	4
C108T C61 C76 C77	CAP, CER, 5PF, 1KV	DD-050	CRL	1500-00-5011	4
C99 C82	CAP, CER, 10PF, 1KV	DD-100	CRL	1500-01-0011	2
C102 C87	CAP, CER, 100PF, 1KV	DD-101	CRL	1500-01-0111	2
C13 C22 C9	CAP, CER, .001MF, 1KV	DD-102	CRL	1500-01-0211	3
C1 C101 C103 C104 C11 C110 C16 C17 C18 C20 C21 C24 C27 C29 C3 C30 C32 C33 C4 C42 C43 C44 C5 C53 C54 C56 C57 C58 C60 C62 C63 C66 C68 C71 C72 C73 C74 C75 C80 C81 C83 C84 C89 C90 C92	CAP, CER, MIN, .01MF, 50V	CAC02Z5U103Z100A	CORNO	1500-01-0310	45
C105 C106 C107 C109 C67 C78 C79 C85 C86 C88 C91 C93 C94	CAP, CER, MON, .1MF, 50V	CAC03Z5U104Z050A	CORNO	1500-01-0405	13
C2	CAP, CER, 150PF, 1KV	DD-151	CRL	1500-01-5111	1
C10 C14	CAP, CER, 330PF, 1KV	DD-331	CRL	1500-03-3111	2
C26	CAP, MICA, 100PF, 300V	DM15-101J	ARCO	1500-11-0100	1

WAVETEK PARTS LIST | TITLE: PCA, GENERATOR | ASSEMBLY NO: 1100-00-0556 | PAGE 1 | REV T

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO	QTY/PT
	CAP SET POLYC MIXED MATCHED SET			1509-80-0008	
C38	CAP, POLYC, 1MF, 100V PART OF 1509-80-0008 QTY(1)				
C39	CAP, POLYC, 1MF, 100V PART OF 1509-80-0008 QTY(1)				
NONE	GENERATOR	145-0556	WVTK	1700-00-0556	1
NONE	CONN, 9PIN	09-60-1091	MOLEX	2100-02-0052	1
NONE	SOLDER LUG	1497	SMITH	2100-04-0012	5
NONE	TERM	2060B1	UBECO	2100-05-0009	4
NONE	PIN, MALE	61182-2	AMP	2100-05-0020	20
NONE	HEAT SINK	207	WAKE	2800-11-0001	2
NONE	TRANSIPAD	10123N	METRS	2800-11-0003	2
NONE	TRANSIPAD	10160	METRS	2800-11-0004	4
NONE	HEATSINK	26068H3E	WAKE	2800-11-0012	2
FB1	FERRITE BEAD	56-590-65/3B	FERRI	3100-00-0001	1
R4 R48	POT, TRIM, 1K	91AR1K	BECK	4600-01-0209	2
R12 R162 R55	POT, TRIM, 10K	91AR10K	BECK	4600-01-0313	3

WAVETEK PARTS LIST | TITLE: PCA, GENERATOR | ASSEMBLY NO: 1100-00-0556 | PAGE 3 | REV T

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO	QTY/PT
R172 R173 R196 R210 R236T R24 R273 R30 R50 R61 R64 R74 R81 R84					
R211 R212	RES, MF, 1/8W, 1%, 1 1K	RN55D-1101F	TRW	4701-03-1101	2
R239 R240 R250 R251	RES, MF, 1/8W, 1%, 11K	RN55D-1102F	TRW	4701-03-1102	4
R96 R97	RES, MF, 1/8W, 1%, 1 21K	RN55D-1211F	TRW	4701-03-1211	2
R263T	RES, MF, 1/8W, 1%, 13K	RN55D-1302F	TRW	4701-03-1302	1
R114 R241 R247 R66	RES, MF, 1/8W, 1%, 150	RN55D-1500F	TRW	4701-03-1500	4
R113 R176 R18 R198 R23 R267 R32 R36 R62 R63 R9	RES, MF, 1/8W, 1%, 1 5K	RN55D-1501F	TRW	4701-03-1501	11
R132 R163 R2	RES, MF, 1/8W, 1%, 15K	RN55D-1502F	TRW	4701-03-1502	3
R182	RES, MF, 1/8W, 1%, 150K	RN55D-1503F	TRW	4701-03-1503	1
R218 R219 R220 R221	RES, MF, 1/8W, 1%, 19	RN55D-1580F	TRW	4701-03-1509	4
R169	RES, MF, 1/8W, 1%, 1 78K	RN55D-1781F	TRW	4701-03-1781	1
R184	RES, MF, 1/8W, 1%, 1 96K	RN55D-1961F	TRW	4701-03-1961	1
R179	RES, MF, 1/8W, 1%, 200	RN55D-2000F	TRW	4701-03-2000	1
R1 R15 R183 R209 R31	RES, MF, 1/8W, 1%, 2K	RN55D-2001F	TRW	4701-03-2001	5
R143	RES, MF, 1/8W, 1%, 215	RN55D-2150F	TRW	4701-03-2150	1

WAVETEK PARTS LIST | TITLE: PCA, GENERATOR | ASSEMBLY NO: 1100-00-0556 | PAGE 5 | REV T

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO	QTY/PT
C25	CAP, MICA, 15PF, 500V	DM15-150J	ARCO	1500-11-5000	1
C28 C31 C99T	CAP, MICA, 220PF, 300V	DM15-221J	ARCO	1500-12-2100	3
C41T	CAP, MICA, 36PF, 300V	DM15-360J	ARCO	1500-13-6000	1
C46 C51	CAP, MICA, 47PF, 500V	DM13-470J	ARCO	1500-14-7000	2
C47 C50	CAP, MICA, 68PF, 500V	DM15-680J	ARCO	1500-16-8000	2
C35T	CAP, MICA, 82PF, 300V	DM15-820J	ARCO	1500-18-2000	1
C36	CAP, MICA, 820PF, 300V	DM15-821F	ARCO	1500-18-2101	1
C19	CAP, POLYC, 1MF, 100V	210-81C-105F	IKB	1500-41-0504	1
C34 C40	VARI, 3.5-13PF, 250V	78-TRIKD-02 3.5/13PF	TRIKO	1500-51-3000	2
C12 C8 C96 C97	CAP, TANT, 1MF, 35V	150D105X9035A2	SPRAG	1500-71-0502	4
C69	POLTANT22MF20%	202A2002226M3	MATSO	1500-72-2621	1
C95 C98	POLTANT27MF20%	196D276X0035TE4	SPRAG	1500-72-7602	2
C111 C112 C64 C65	CAP, TANT, 5 6MF, 35V	150D565X9035B2	SPRAG	1500-75-6502	4
	CAP SET, POLYC MIXED MATCHED SET	180-301	WVTK	1509-80-0008	1
C37	CAP, POLYC, .01MF, 100V PART OF 1509-80-0008 QTY(1)				

WAVETEK PARTS LIST | TITLE: PCA, GENERATOR | ASSEMBLY NO: 1100-00-0556 | PAGE 2 | REV T

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO	QTY/PT
R13 R16 R181 R252	POT, TRIM, 100K	91AR100K	BECK	4600-01-0402	4
R120	POT, TRIM, 200	91AR200	BECK	4600-02-0101	1
R107 R35 R93	POT, TRIM, 500	91AR500	BECK	4600-05-0104	3
R276 R30	POT, SWITCH, 10K	4602-01-0300	WVTK	4602-01-0300	2
R10	POT, CONT, 10K FROM 4600-01-0312	4609-71-0301	WVTK	4609-71-0301	1
R185	POT, CONT, 500 FROM 4600-05-0105	4609-73-0101	WVTK	4609-73-0101	1
R11 R8	RES, C, 1/2W, 10%, 5 1M	RC20GF515	STKPL	4700-25-5104	2
R17	RES, C, 1/2W, 10%, 6 8M	RC20GF685	STKPL	4700-25-6804	1
R118 R124 R127 R128 R129 R142 R145 R149 R153 R156 R174 R180 R197T R206T R214 R216 R49 R57 R73	RES, MF, 1/8W, 1%, 100	RN55D-1000F	TRW	4701-03-1000	19
R104 R108 R111 R155 R165 R168 R200 R257 R43 R47 R51 R94 R98 R99	RES, MF, 1/8W, 1%, 1K	RN55D-1001F	TRW	4701-03-1001	14
R112 R146 R203 R265 R41	RES, MF, 1/8W, 1%, 10K	RN55D-1002F	TRW	4701-03-1002	5
R116 R123 R139 R141	RES, MF, 1/8W, 1%, 10	RN55D-10R0F	TRW	4701-03-1009	18

WAVETEK PARTS LIST | TITLE: PCA, GENERATOR | ASSEMBLY NO: 1100-00-0556 | PAGE 4 | REV T

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO	QTY/PT
R166 R170	RES, MF, 1/8W, 1%, 21 5	RN55D-21R5F	TRW	4701-03-2159	2
R237 R248	RES, MF, 1/8W, 1%, 23 7K	RN55D-2372F	TRW	4701-03-2372	2
R102 R137 R144 R159 R186 R230 R242 R249 R25 R262 R39	RES, MF, 1/8W, 1%, 249	RN55D-2490F	TRW	4701-03-2490	11
R147 R151 R156 R171 R188 R189 R19 R234 R253 R274 R278 R33	RES, MF, 1/8W, 1%, 2 49K	RN55D-2491F	TRW	4701-03-2491	12
R161 R213 R281 R283	RES, MF, 1/8W, 1%, 24 9K	RN55D-2492F	TRW	4701-03-2492	4
R187T	RES, MF, 1/8W, 1%, 27 4	RN55D-27R4F	TRW	4701-03-2749	1
R150 R177 R178 R43	RES, MF, 1/8W, 1%, 3 01K	RN55D-3011F	TRW	4701-03-3011	4
R131 R256	RES, MF, 1/8W, 1%, 301K	RN55D-3013F	TRW	4701-03-3013	2
R134 R67 R71 R88 R89	RES, MF, 1/8W, 1%, 316	RN55D-3160F	TRW	4701-03-3160	5
R100T R105T	RES, MF, 1/8W, 1%, 3 32K	RN55D-3321F	TRW	4701-03-3321	2
R101 R103 R109 R110 R119 R126 R130 R140 R192 R204 R233 R269 R272 R63 R68 R69 R72 R73 R76 R79 R82 R93	RES, MF, 1/8W, 1%, 33 2	RN55D-33R2F	TRW	4701-03-3329	22
R191 R202 R258 R80 R83	RES, MF, 1/8W, 1%, 3 65K	RN55D-3651F	TRW	4701-03-3651	5
R115 R193 R194 R195	RES, MF, 1/8W, 1%, 392	RN55D-3920F	TRW	4701-03-3920	4

WAVETEK PARTS LIST | TITLE: PCA, GENERATOR | ASSEMBLY NO: 1100-00-0556 | PAGE 6 | REV T

REMOVE ALL BURRS AND BREAK SHARP EDGES | DRAWN | DATE | MATERIAL | FINISH: WAVETEK PROCESS | PROJECT APPROV | TOLERANCE UNLESS OTHERWISE SPECIFIED XXX .010 XX .030 ANGLES 1° | DO NOT SCALE DWG | SCALE

WAVETEK SAN DIEGO, CALIFORNIA

TITLE: PARTS LIST PCA, GENERATOR

MODEL NO: 145 | DWG NO: 1100-00-0556 | REV T | CODE IDENT: 23338 | SHEET 1 OF 2

NOTE: UNLESS OTHERWISE SPECIFIED

SUNDAY GRAPH CELACOMPRESS PATCHED REF. 0.0894

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REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO	QTY/PT
R199 R42	RES.MF,1/8W,1%,4.02K	RN55D-4021F	TRW	4701-03-4021	2
R106 R205 R206 R207	RES.MF,1/8W,1%,464	RN55D-4640F	TRW	4701-03-4640	4
R201	RES.MF,1/8W,1%,46.4K	RN55D-4642F	TRW	4701-03-4642	1
R5	RES.MF,1 8W,1%,46.4	RN55D-46R4F	TRW	4701-03-4649	1
R34	RES.MF,1/8W,1%,4.75K	RN55D-4751F	TRW	4701-03-4751	1
R231 R259	RES.MF,1/8,1%,499	RN55D-4990F	TRW	4701-03-4990	2
R117 R14 R152 R20 R22 R232 R3 R37	RES.MF,1/8W,1%,4.99K	RN55D-4991F	TRW	4701-03-4991	8
R137	RES.MF,1/8W,1%,49.9K	RN55D-4992F	TRW	4701-03-4992	1
R85T R92T	RES.MF,1/8W,1%,54.9	RN55D-54R9F	TRW	4701-03-5499	2
R235	RES.MF,1/8W,1%,56.2	RN55D-56R2F	TRW	4701-03-5629	1
R148T R243 R246	RES.MF,1/8W,1%,576	RN55D-5760F	TRW	4701 03 5760	3
R21 R40 R44 R86 R91	RES.MF,1/8W,1%,604	RN55D-6040F	TRW	4701-03-6040	5
R213 R217 R234 R244 R260 R268 R275	RES.MF,1/8W,1%,61.9	RN55D-61R9F	TRW	4701-03-6199	7
R264 R270	RES.MF,1/8W,1%,681	RN55D-6810F	TRW	4701-03-6810	2
R46	RES.MF,1/8W,1%,6.98K	RN55D-6981F	TRW	4701-03-6981	1
R133 R167 R190 R60	RES.MF,1/8W,1%,750	RN55D-7500F	TRW	4701-03-7500	5

WAVETEK PARTS LIST — TITLE: PCA, GENERATOR — ASSEMBLY NO 1100-00-0556 — PAGE 7 — REV T

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO	QTY/PT
	RES.NF,MIXED SET	4789-00-0043	WVTK	4789-00-0043	1
R52	RES.MF,1/8W,1%,10K PART OF 4789-00-0043 QTY(1)				
R53	RES.MF,1/8W,1%,100K PART OF 4789-00-0043 QTY(1)				
R54	RES.MF,1/4W,1%,1M PART OF 4789-00-0043 QTY(1)				
R56	RES.MF, 6W,1%,10M	ML-1B1	CADDO	4799-00-0003	1
CR3 CR33 CR4 CR5	DIODE,ZENER 6.2V	1N823A	MOT	4801-01-0829	4
CR16	DIODE	1N4581	MICRO	4801-01-4581	1
CR19 CR28 CR29 CR30 CR31 CR6 CR7 CR8 CR9	DIODE	FD777	FAIR	4807-02-0777	9
CR1 CR10 CR11 CR14 CR15 CR17 CR18 CR20 CR21 CR22 CR23 CR24 CR25 CR27 CR32 CR34 CR35 CR36 CR37 CR46	DIODE	1N4148	FAIR	4807-02-4666	20
CR12 CR13	DIODE	5082-281	HP	4809-02-2811	2
CR2 CR26	DIODE,M/PR,FD-777 QTY 2 4807-02-0777	164-501-9	WVTK	4898-00-0004	1
CR38 CR39 CR40 CR41	DIODE,BET,8-FD-777	182-500-98	WVTK	4898-00-0010	1

WAVETEK PARTS LIST — TITLE: PCA, GENERATOR — ASSEMBLY NO 1100-00-0556 — PAGE 9 — REV T

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO	QTY/PT
	QTY 2 4901-03-4830				
SW1-A SW1-B SW1-C SW1-D SW1-E SW1-F SW4-A SW4-B SW4-C SW4-D SW4-E SW3-A SW3-B SW3-C	WAFER	147-400	WVTK	5104-02-0015	14
NONE	SWITCH STOP	211-33-001	CTS	5104-07-0001	1
NONE	SWITCH STOP	215-13-001-01-22	CTS	5104-07-0003	1
SW1	DETENT MOD FROM 5104-01-0010	5104-99-0028	WVTK	5104-99-0028	1
SW5	DETENT MOD FROM 5104-01-0010	5104-99-0029	WVTK	5104-99-0029	1
SW4	DETENT MOD FROM 5104-01-0010	5104-99-0030	WVTK	5104-99-0030	1
NONE	WIRE,HK,22GA	15U-BLACK	GAVTT	6000-32-2000	1
NONE	WIRE,MU,22GA	15U-BROWN	GAVTT	6000-32-2001	1
NONE	WIRE,MU,22GA	15U-RED	GAVTT	6000-32-2002	1
NONE	WIRE,MU,22GA	15U-ORANGE	GAVTT	6000-32-2003	1
NONE	WIRE,MU,22GA	15U-YELLOW	GAVTT	6000-32-2004	1
NONE	WIRE,MU,22GA	15U-GREEN	GAVTT	6000-32-2005	1
NONE	WIRE,MU,22GA	15U-BLUE	GAVTT	6000-32-2006	1

WAVETEK PARTS LIST — TITLE: PCA, GENERATOR — ASSEMBLY NO 1100-00-0556 — PAGE 11 — REV T

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO	QTY/PT
R70					
R133 R136 R138 R160 R164 R261 R266 R77 R78	RES.MF,1/8W,1%,7.5K	RN59D-7501F	TRW	4701-03-7501	9
R154	RES.MF,1/8W,1%,76.8K	RN55D-7682F	TRW	4701-03-7682	1
R123	RES.MF,1/8W,1%,825	RN55D-8250F	TRW	4701-03-8250	1
R238 R249 R38	RES.MF,1/8W,1%,8.25K	RN55D-8251F	TRW	4701-03-8251	3
R39	RES.MF,1/8W,1%,82.5	RN55D-8252F	TRW	4701-03-8259	1
R122 R228	RES.MF,1/8W,1%,909	RN55D-9090F	TRW	4701-03-9090	2
R271	RES.MF,1/8W,1%,90.9	RN55D-9089F	TRW	4701-03-9099	1
R7	RES.MF,1/4W,1%,1M	RN60D-1004F	TRW	4701-13-1004	1
R233	RES.MF,1/4W,1%,121	RN60D-1210F	TRW	4701-13-1210	1
R229	RES.MF,1/4W,1%,124	RN60D-1240F	TRW	4701-13-1240	1
R173	RES.MF,1/4W,1%,49.9	RN60D-49R9F	TRW	4701-13-4999	1
R6T	RES.MF,1/4W,1%,698K	RN60D-6983F	TRW	4701-13-6983	1
R224 R225 R226 R227	RES.MF,1/2W,1%,49.9	RN65D-49R9F	TRW	4701-23-4999	4

WAVETEK PARTS LIST — TITLE: PCA, GENERATOR — ASSEMBLY NO 1100-00-0556 — PAGE 8 — REV T

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO	QTY/PT
CR42 CR43 CR44 CR45	QTY 8 4807-02-0777				
Q42	TRANS	2N2219A	NSC	4901-02-2191	1
Q43	TRANS	2N2905A	NSC	4901-02-9051	1
Q12 Q36 Q50	TRANS	2N3563	FAIR	4901-03-5630	3
Q13 Q16 Q37 Q49	TRANS	2N3640	FAIR	4901-03-6400	4
Q39 Q44	TRANS	2N3866	MOT	4901-03-8660	2
Q11 Q21 Q22 Q25 Q27 Q28 Q29 Q31 Q40 Q6	TRANS	2N3903	NSC	4901-03-9030	10
Q10 Q11 Q14 Q17 Q19 Q23 Q24 Q26 Q30 Q32 Q33 Q34 Q4 Q41 Q46 Q47 Q51	TRANS	2N3908	ITT	4901-03-9050	17
Q38 Q45	TRANS	2N3160-18	MOT	4901-05-1600	2
Q3	TRANS	2N5460	MOT	4901-05-4600	1
Q5	TRANS	2N5485	MOT	4901-05-4850	1
Q1	TRANS	2N5486	MOT	4901-05-4860	1
Q18 Q20	TRANS,M/PR,2N3563 QTY 2 4901-03-5630	142-501-82	WVTK	4998-00-0004	1
Q2 Q7	TRANS,SEL,2N5462 QTY 1 4901-05-4620	142-501-55	WVTK	4998-00-0008	2
Q8 Q9	TRANS,M/PR,2N5485	142-501-53	WVTK	4998-00-0009	1

WAVETEK PARTS LIST — TITLE: PCA, GENERATOR — ASSEMBLY NO 1100-00-0556 — PAGE 10 — REV T

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO	QTY/PT
NONE	WIRE,MU,22GA	15U-VIOLET	GAVTT	6000-32-2007	1
NONE	WIRE,MU,22GA	15U-GRAY	GAVTT	6000-32-2008	1
NONE	WIRE,MU,22GA	15U-WHITE/BLACK	GAVTT	6000-32-2090	1
NONE	WIRE,MU,22GA	15U-WHITE/BROWN	GAVTT	6000-32-2091	1
NONE	WIRE,MU,22GA	15U-WHITE/RED	GAVTT	6000-32-2092	1
NONE	WIRE,MU,22GA	15U-WHITE/ORANGE	GAVTT	6000-32-2093	1
NONE	WIRE,MU,22GA	15U-WHITE/YELLOW	GAVTT	6000-32-2094	1
NONE	WIRE,MU,22GA	15U-WHITE/GREEN	GAVTT	6000-32-2095	1
IC4 IC9	IC	LM741CN	NSC	7000-07-4100	2
Q35 Q48	IC	AD 812	ANDEV	7000-08-1200	2
IC1 IC2 IC6	IC	MC1458P1	MOT	7000-14-5800	3
IC9	IC	CA3094T	RCA	7000-30-4900	1
IC7 IC8	IC	CA3140E	RCA	7000-31-4001	2

WAVETEK PARTS LIST — TITLE: PCA, GENERATOR — ASSEMBLY NO 1100-00-0556 — PAGE 12 — REV T

NOTE UNLESS OTHERWISE SPECIFIED

REMOVE ALL BURRS AND BREAK SHARP EDGES — MATERIAL — F.N.S.H. WAVETEK PROCESS — DRAWN — DATE — PROJ MGR — RELEASE APPROV — TOLERANCE UNLESS OTHERWISE SPECIFIED .XXX ± .010 ANGLES 1° .XX ± .030 — DO NOT SCALE DWG — SCALE

WAVETEK SAN DIEGO, CALIFORNIA

TITLE: PARTS LIST PCA, GENERATOR

MODEL NO 145 — DWG NO 1100-00-0556 — REV T — CODE IDENT 23338 — SHEET 2 OF 2

BISHOP GRAPHICS/ACCUPRESS PREVIOUS NO. X 5804

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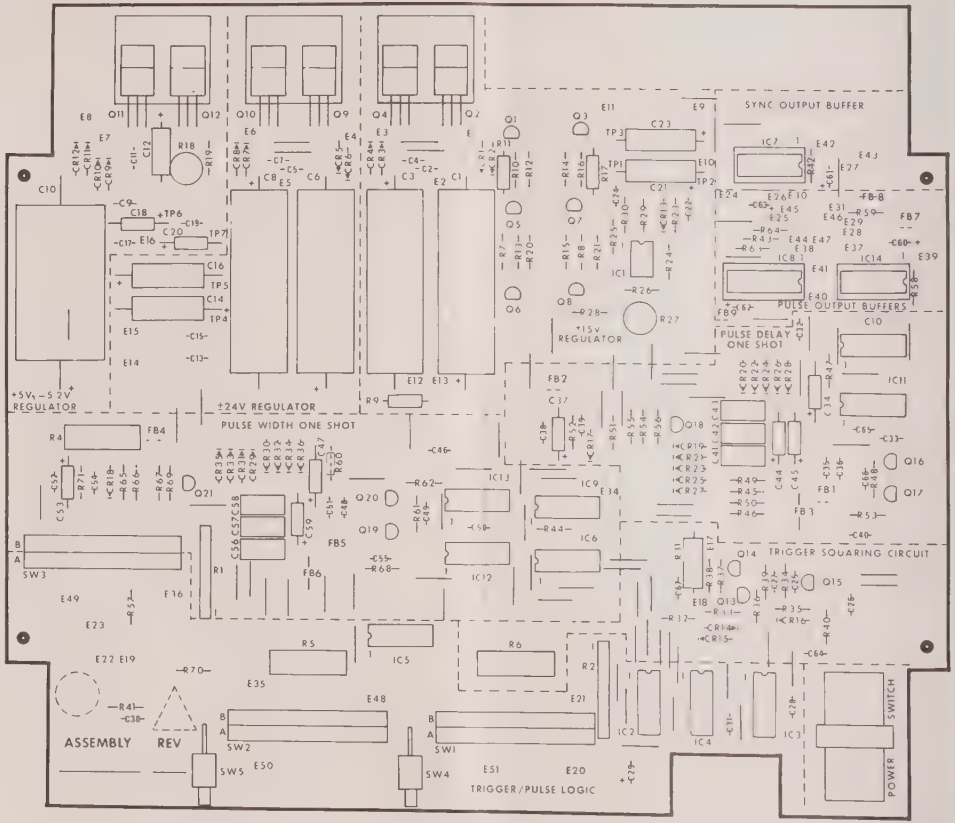

WAVETEK SAN DIEGO, CA FORM A			
PRINTED WIRING BOARD AS MASTER HANDSOLD	DRAWN	DATE	
MATERIAL	PROJ ENGR		
FINISH WAVETEK PROCESS	MFG ENGR		
	TOLERANCE UNLESS OTHERWISE SPECIFIED .XX ±.01 .XXX ±.005 ANGLES ±1°		
	DO NOT SCALE DWG		
	SCALE		

TITLE: TRIG/PULSE BOARD PARTS LOCATOR

MODEL NO	DWG NO	REV
143/145	0100-00-0565	C

CODE IDENT 23338 SHEET # OF #

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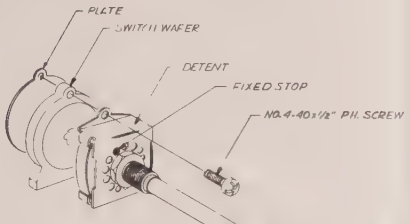
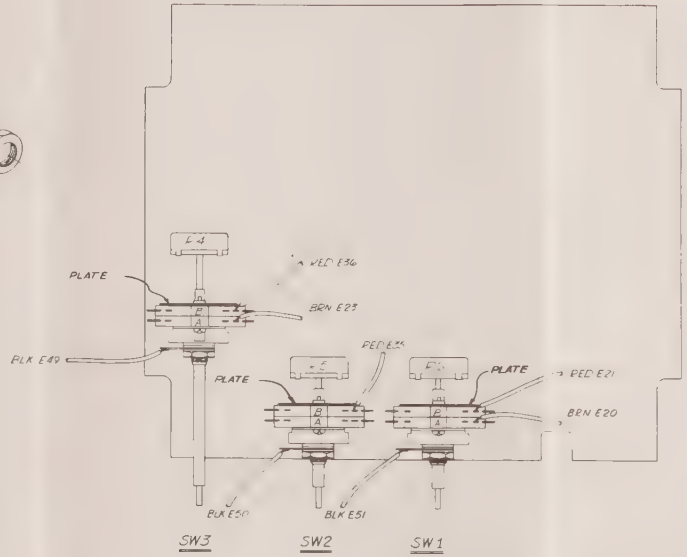
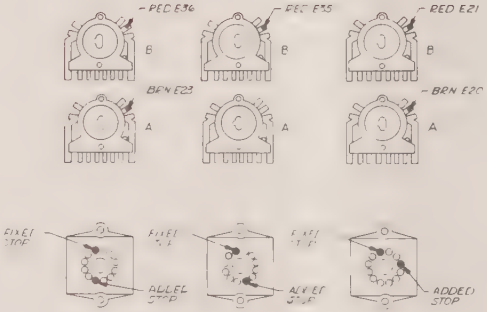
REV	ECN	BY	DATE	APP



TYPICAL HARDWARE STACK-UP

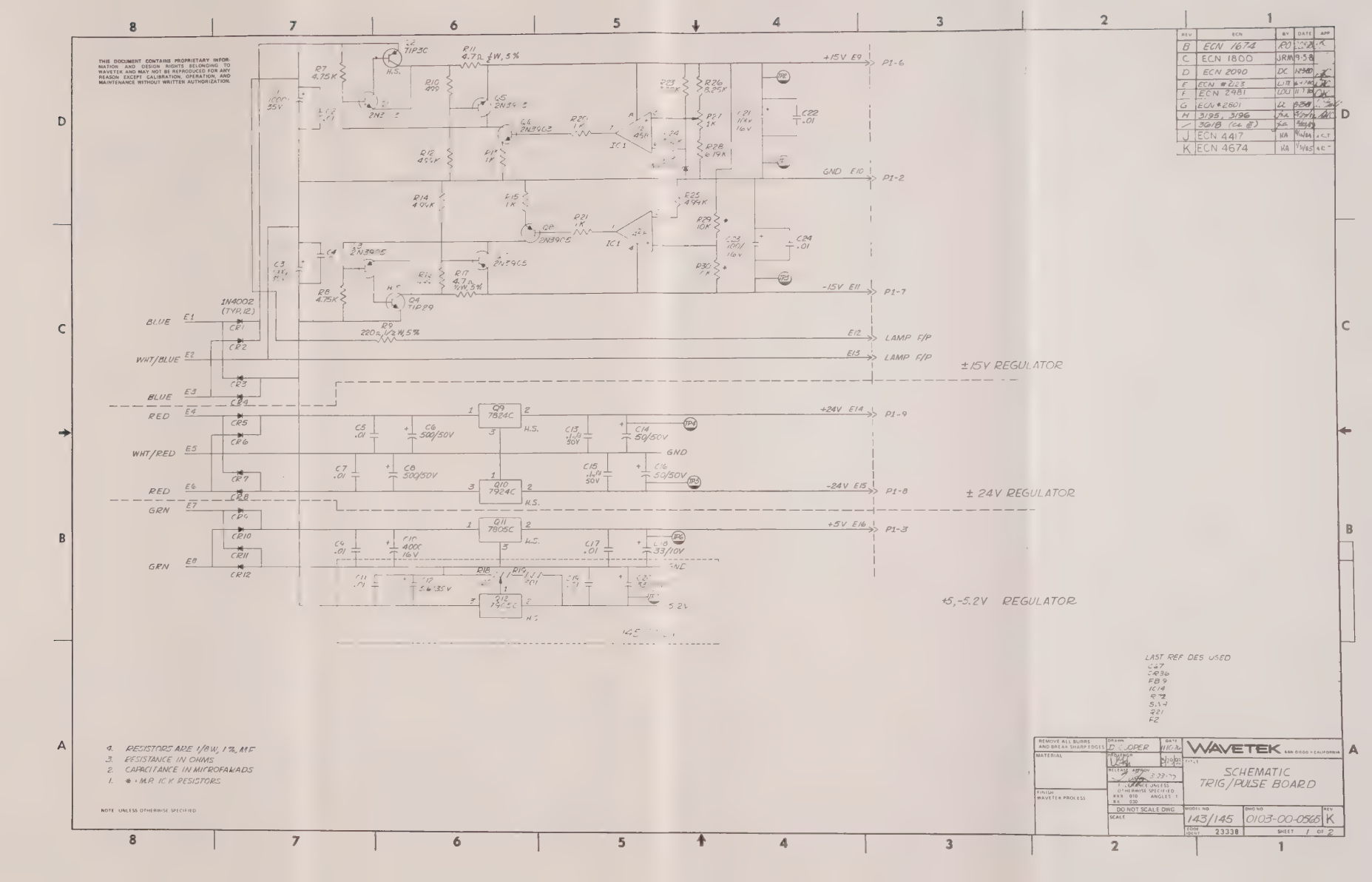




DETENT SHOWN FROM FRONT VIEW IN FULL COUNTER CLOCKWISE POSITION

NOTE UNLESS OTHERWISE SPECIFIED

REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN D. COOPER	DATE 12-7-77	WAVETEK SAN DIEGO, CALIFORNIA
MATERIAL	PROJECT	12-22-77	TITLE ASSEMBLY TRIG/PULSE BD.
FINISH WAVETEK PROCESS	RELEASE		
	TOLERANCE UNLESS OTHERWISE SPECIFIED XXX .010 ANGLES ±1 XX .030		
	DO NOT SCALE DWG		MODEL NO 145
	SCALE		DWG NO 0101-00-0565 REV K
			CODE IDENT 23338 SHEET 2 OF 2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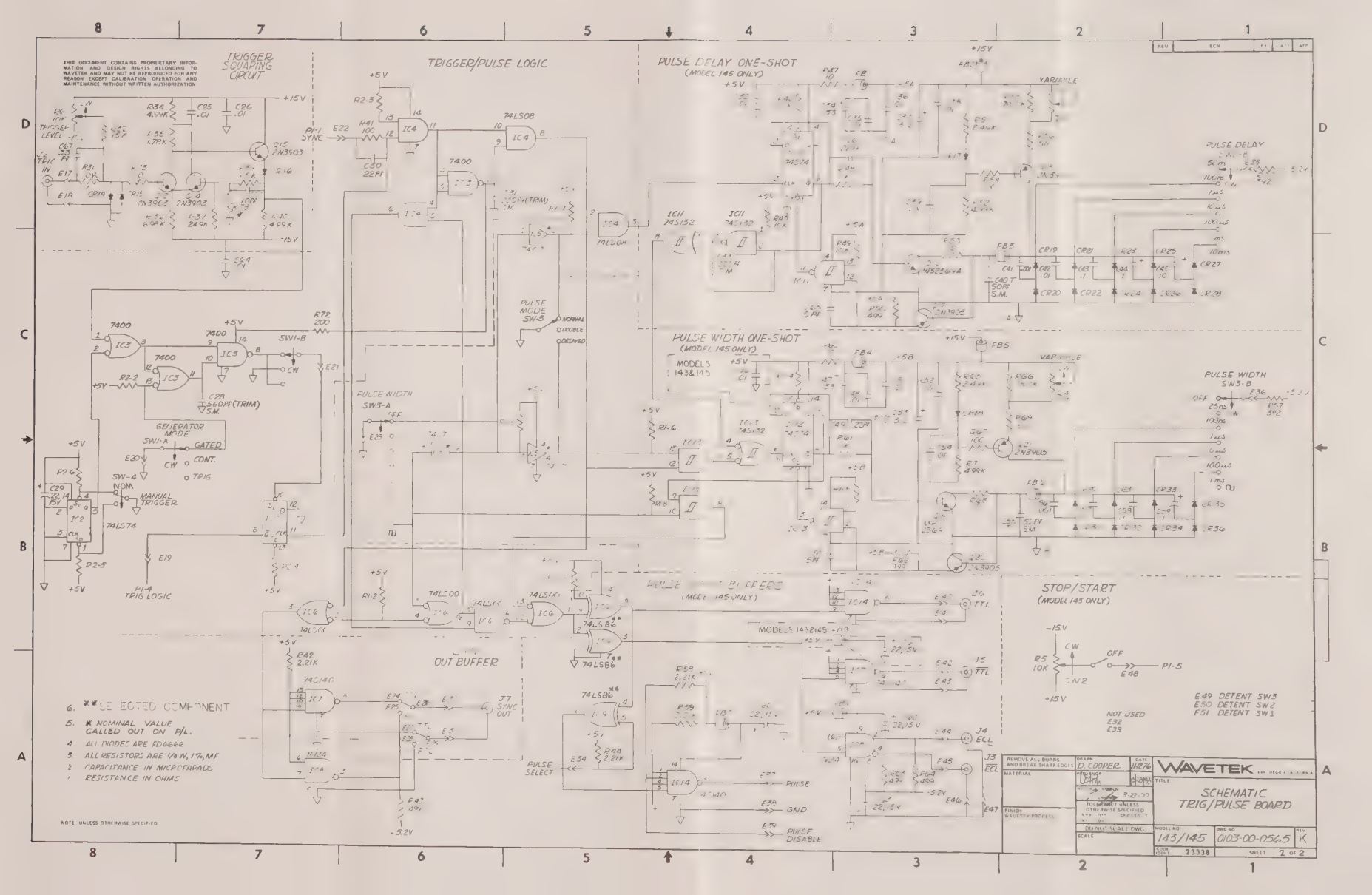
+15V E9
P1-6
GND E10
P1-2
-15V E11
P1-7
E12 LAMP F/P
E13 LAMP F/P
±15V REGULATOR
+24V E14
P1-9
-24V E15
P1-8
± 24V REGULATOR
+5V E16
P1-3
5,-5.2V REGULATOR
BLUE E1
WHT/BLUE E2
BLUE E3
RED E4
WHT/RED E5
RED E6
GRN E7
GRN E8
1N4002 (TYP.12)
TIP3C
TIP29
2N3905
2N3903
2N3904
2N3906
Q9 7824C
Q10 7924C
Q11 7805C
Q12 7905C
IC1
R7 4.75K
R8 4.75K
R9 220Ω 1/2W 5%
R10 909
R11 4.7Ω 1/4W 5%
R12 909
R13 4.7Ω 1/4W 5%
R14 4.99K
R15 1K
R16 1K
R17 1K
R18 1K
R19 1K
R20 1K
R21 1K
R22 45K
R23 4.99K
R24 4.99K
R25 4.99K
R26 8.25K
R27 1K
R28 6.19K
R29 10K
R30 1K
C1 1000/35V
C2 .01
C3 1000/35V
C4 .01
C5 .01
C6 500/50V
C7 .01
C8 500/50V
C9 .01
C10 400/16V
C11 .01
C12 5.6/35V
C13 1.0/50V
C14 50/50V
C15 1.0/50V
C16 50/50V
C17 .01
C18 33/10V
C19 .01
C20 2.2/35V
C21 100/16V
C22 .01
C23 100/16V
C24 .01
H.S.
GND
LAST REF DES USED
C27
C30
FB9
IC14
Q13
S.W.
T21
F2
1. RESISTORS ARE 1/8W, 1%, MF
3. RESISTANCE IN OHMS
2. CAPACITANCE IN MICROFARADS
1. * = M.P. IC'K RESISTORS
NOTE UNLESS OTHERWISE SPECIFIED
REV ECN BY DATE APP
B ECN 1674 RO 11-76 K
C ECN 1800 JRM 9-5-8
D ECN 2090 DC 12-80
E ECN #223 LJB 6-7-82
F ECN 2981 LJB 11-1-84
G ECN #2801 LL 8-28-85
H 3195, 3196 MA 5-7-86
I 3618 (CC #) MA 5-16-86
J ECN 4417 MA 11-6-86 A.C.T.
K ECN 4674 MA 3-3-87 A.C.T.
REMOVE ALL BURRS AND BREAK SHARP EDGES
MATERIAL
FINISH WAVETEK PROCESS
DRAWN D. ODER 11-76
ENGINEER
RELEASE APPROV
3-22-77
UNLESS OTHERWISE SPECIFIED
.XX ±.010 ANGLES ±1
.XXX ±.030
DO NOT SCALE DWG
SCALE
WAVETEK SAN DIEGO, CALIFORNIA
SCHEMATIC TRIG/PULSE BOARD
MODEL NO 143/145
DWG NO 0103-00-0565
REV K
CODE IDENT 23338
SHEET 1 OF 2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TRIGGER SQUAPING CIRCUIT
TRIGGER/PULSE LOGIC
PULSE DELAY ONE-SHOT
(MODEL 145 ONLY)
PULSE WIDTH ONE-SHOT
(MODEL 145 ONLY)
MODELS 143 & 145
PULSE MODE SW-5
NORMAL
DOUBLE
DELAYED
PULSE WIDTH SW3-A
PULSE WIDTH SW3-B
GENERATOR MODE SW1-A
GATED
CONT.
TRIG
SW-4 NON
MANUAL TRIGGER
SW1-B
CW
PULSE DELAY
PULSE WIDTH
OUT BUFFER
PULSE BUFFERS
(MODEL 145 ONLY)
STOP/START
(MODEL 143 ONLY)
SW2
OFF
CW
PULSE SELECT
PULSE
GND
PULSE DISABLE
J7 SYNC OUT
J6 TTL
J5 TTL
J4 ECL
J3 ECL
NOT USED
E32
E33
E49 DETENT SW3
E50 DETENT SW2
E51 DETENT SW1
6. **SELECTED COMPONENT
5. * NOMINAL VALUE CALLED OUT ON P/L.
4. ALL DIODES ARE FD6666
3. ALL RESISTORS ARE 1/8W, 1%, MF
2. CAPACITANCE IN MICROFARADS
1. RESISTANCE IN OHMS
NOTE UNLESS OTHERWISE SPECIFIED
REMOVE ALL BURRS AND BREAK SHARP EDGES
MATERIAL
FINISH WAVETEK PROCESS
DRAWN D. COOPER
DATE 1/16/76
ENGINEER
DATE
TOLERANCE UNLESS OTHERWISE SPECIFIED
DO NOT SCALE DWG
SCALE
WAVETEK
TITLE
SCHEMATIC TRIG/PULSE BOARD
MODEL NO 143/145
DWG NO 0105-00-0565
REV K
CODE IDENT 23338
SHEET 2 OF 2

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REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO	QTY/PT
NONE	ASSY DRWG TRIG/PULSE	0101-00-0565	WVTK	0101-00-0565	1
NONE	SCHEMATIC TRIG/PULSE	0103-00-0565	WVTK	0103-00-0565	1
NONE	ASSY, LAMP 143-145	143-145-1960	WVTK	1207-00-1960	1
NONE	ASSY, COAX 143-145-0565	143-145-1962	WVTK	1207-00-1962	1
NONE	ASSY, COAX 143-145-0565	143-145-1963	WVTK	1207-00-1963	1
NONE	ASSY COAX 145-0565	145-1978	WVTK	1207-00-1978	1
NONE	ASSY, COAX 145-0565	145-1979	WVTK	1207-00-1979	1
NONE	ASSY COAX 145-0565	145-1980	WVTK	1207-00-1980	1
NONE	ASSY COAX 145-0565	145-1981	WVTK	1207-00-1981	1
NONE	ASSY COAX 145-0565	145-1982	WVTK	1207-00-1982	1
NONE	ASSY, MOLEX CONN HARNESS 145-0565	145-1983	WVTK	1207-00-1983	1
NONE	PLATE:SW	008-004	WVTK	1400-00-2130	3
NONE	BRKT,HEAT SINK	102-308	WVTK	1400-00-5143	3
C50 C63	CAP,CER,5PF,1KV	DD-050	CRL	1500-00-5011	2
C27	CAP,CER,10PF,1KV	DD-100	CRL	1500-01-0011	1
C11 C17 C19 C2 C22	CAP,CER,MN, 01MF,50V	CAC0225U103Z100A	CORNG	1500-01-0310	23

WAVETEK PARTS LIST | TITLE: PCA, TRIGGER/PULSE | ASSEMBLY NO: 1100-00-0565 | REV: 0 | PAGE 1

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO	QTY/PT
C45	CAP, TANT, 10MF 20V	150D106X9020B2	SPRAG	1500-71-0601	1
C29 C60 C61 C62 C63	POLTANT22MF20...	202A2002226MJ	MATSO	1500-72-2621	5
C18 C20 C34 C47	CAP,TANT,33MF 10V	150D336X9010B2	SPRAG	1500-73-3601	4
C12 C37 C53	CAP, TANT, 3.3MF 35V	150D635X9035B2	SPRAG	1500-75-6302	3
NONE	TRIGGER/PULSE	145-0565	WVTK	1700-00-0565	1
P1	CONN, 9PIN	09-50-7091	MOLEX	2100-02-0051	1
NONE	SKT, IC, 14 PIN	DILB14P-108	BURND	2100-03-0066	2
NONE	SKT, IC, 16 PIN	DILB16P-108	BURND	2100-03-0067	1
1	SOLDER LUG	1497	SMITH	2100-04-0012	3
NONE	PIN	08-50-0105	MOLEX	2100-05-0025	9
NONE	STANDOFF 1 700 H, 250 HEX 4 40	P-609-M03-F05 440	WVTK	2800-02-0016	4
1	WASHER	851547F015	MOT	2800-11-0015	6
FB1 FB2 FB3 FB4 FB5 FB6 FB7 FB8 FB9	FERRITE BEAD	56-590-65/3B	FERR	3100-00-0001	9
2	INSULATOR(TO 220)	60-11-8302-1674	CHOMR	3100-00-0010	6
R27	POT, TRIM, 1K	91AR1K	BECK	4600-01-0209	1
R10	POT, TRIM, 20	91AR20	BECK	4600-02-0000	1

WAVETEK PARTS LIST | TITLE: PCA, TRIGGER/PULSE | ASSEMBLY NO: 1100-00-0565 | REV: 0 | PAGE 3

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO	QTY/PT
R19	RES, MF 1/8W, 1%, 301	RN55D-3010F	TRW	4701-03-3010	1
R23	RES, MF 1/8W 1% 3.32K	RN55D-3321F	TRW	4701-03-3321	1
R57 R70	RES, MF 1/8W, 1%, 392	RN55D-3920F	TRW	4701-03-3920	2
R24	RES, MF, 1/8W, 1%, 3.92K	RN55D-3921F	TRW	4701-03-3921	1
R38T	RES, MF, 1/8W, 1%, 432	RN55D-4320F	TRW	4701-03-4320	1
R7 R8	RES, MF, 1/8W 1%, 4.75K	RN55D-4751F	TRW	4701-03-4751	2
R10 R16 R43 R50 R62 R63 R64	RES, MF, 1/8, 1%, 499	RN55D-4990F	TRW	4701-03-4990	7
R12 R14 R25 R34 R40 R52 R71	RES, MF, 1/8W, 1%, 4.99K	RN55D-4991F	TRW	4701-03-4991	7
R56 R69	RES, MF, 1/8W, 1%, 511	RN55D-5110F	TRW	4701-03-5110	2
R28	RES, MF, 1/8W, 1%, 6.19K	RN55D-6191F	TRW	4701-03-6191	1
R36	RES, MF, 1/8W, 1%, 6.98K	RN55D-6981F	TRW	4701-03-6981	1
R55 R66	RES, MF, 1/8W, 1%, 78.7K	RN55D-7872F	TRW	4701-03-7872	2
R26	RES, MF, 1/8W, 1%, 8.25K	RN55D-8251F	TRW	4701-03-8251	1
R1 R2	RES, MODULE, 10K	4310R-101-103	BOURN	4770-00-0008	2
R29 R30	RES, SET, 2.10K 1 EW QTY 2 4701-03-1002	142-501-64A	WVTK	4709-00-0019	1
CR13	DIODE	1N4581	MICRO	4801-01-4581	1

WAVETEK PARTS LIST | TITLE: PCA, TRIGGER/PULSE | ASSEMBLY NO: 1100-00-0565 | REV: 0 | PAGE 5

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO	QTY/PT
C24 C29 C26 C32 C35 C36 C38 C39 C4 C46 C48 C5 C51 C52 C54 C64 C7 C9					
C13 C15	CAP, CER, MON, 1MF, 50V	CAC03Z5U104Z050A	CORNG	1500-01-0405	2
C30 C49 C66	CAP, CER, 22PF, 1KV	DD-220	CRL	1500-02-2011	3
C67	CAP, CER, 33PF, 1KV	DD-330	CRL	1500-03-3011	1
C31T C33	CAP, MICA, 220PF, 500V	DM15-221J	ARCO	1500-12-2100	2
C40T C55T	CAP, MICA, 50PF, 500V	DM15-500J	ARCO	1500-15-0000	2
C28T	CAP, MICA, 360PF, 300V	DM15-561J	ARCO	1500-15-6100	1
C21 C23	CAP, ELECT, 100MF, 16V	300D107G016DC7	SPRAG	1500-31-0101	2
C1 C3	CAP, ELECT, 1000MF 35V	39D108G035CL6	SPRAG	1500-31-0212	2
C10	CAP, ELECT, 4000MF, 15V	TC6402U015N1L	MAL	1500-34-0211	1
C14 C16	CAP, ELECT, 50MF, 50V	300D506X0050DD7	SPRAG	1500-35-0003	2
C6 C8	CAP, ELECT, 500MF 50V	39D507G050CL4	SPRAG	1500-35-0103	2
C41 C56	CAP, MYLAR, .001MF100V	225P10291WD3	SPRAG	1500-41-0204	2
C42 C57	CAP, MYLAR, .01MF,100V	225P10391WD3	SPRAG	1500-41-0314	2
C43 C58	CAP, MYLAR, .1MF, 100V	225P10491WD3	SPRAG	1500-41-0444	2
C44 C59	CAP, TANT, 1MF, 35V	150D105X9035A2	SPRAG	1500-71-0502	2

WAVETEK PARTS LIST | TITLE: PCA, TRIGGER/PULSE | ASSEMBLY NO: 1100-00-0565 | REV: 0 | PAGE 2

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO	QTY/PT
R4	POT, CONT, 10K FROM 4600-01-0312	4609-71-0302	WVTK	4609-71-0302	1
R5 R6	POT, CONT, 10K FROM 4600-01-0312	4609-71-0303	WVTK	4609-71-0303	2
R11 R17	RES, C, 1/2W, 5% 4.7	RC20GF-4R7	STKPL	4700-25-0479	2
R9	RES, C, 1/2W, 5% 220	RC20GF-221	STKPL	4700-25-2200	1
R31	RES, C, 1W, 10% 10K	RC32GF-103	STKPL	4700-35-1002	1
R33 R41 R54 R67	RES, MF, 1/8W, 1% 100	RN55D-1000F	TRW	4701-03-1000	4
R13 R15 R20 R21 R48 R61	RES, MF, 1/8W, 1% 1K	RN55D-1001F	TRW	4701-03-1001	6
R45 R46 R49	RES, MF, 1/8W, 1% 10K	RN55D-1002F	TRW	4701-03-1002	3
R47 R53 R60 R68	RES, MF, 1/8W, 1% 10	RN55D-10R0F	TRW	4701-03-1009	4
R39	RES, MF, 1/8W, 1% 1.5K	RN55D-1501F	TRW	4701-03-1501	1
R32	RES, MF, 1/8W, 1% 15K	RN55D-1502F	TRW	4701-03-1502	1
R35	RES, MF, 1/8W, 1% 1.78K	RN55D-1781F	TRW	4701-03-1781	1
R272	RES, MF, 1/8W, 1% 200	RN55D-2000F	TRW	4701-03-2000	1
R42 R44 R58 R59	RES, MF, 1/8W, 1% 2.21K	RN55D-2211F	TRW	4701-03-2211	4
R51 R65	RES, MF, 1/8W, 1% 2.49K	RN55D-2491F	TRW	4701-03-2491	2
R37	RES, MF, 1/8W, 1% 24.9K	RN55D-2492F	TRW	4701-03-2492	1

WAVETEK PARTS LIST | TITLE: PCA, TRIGGER/PULSE | ASSEMBLY NO: 1100-00-0565 | REV: 0 | PAGE 4

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO	QTY/PT
CR1 CR10 CR11 CR12 CR2 CR3 CR4 CR5 CR6 CR7 CR8 CR9	DIODE	1N4002	FAIR	4801-02-0001	12
CR14 CR15 CR16 CR17 CR18 CR19 CR20 CR21 CR22 CR23 CR24 CR25 CR26 CR27 CR28 CR29 CR30 CR31 CR32 CR33 CR34 CR35 CR36	DIODE	1N4148	FAIR	4807-02-6666	23
Q1 Q13 Q14 Q15 Q5 Q6	TRANS	2N3903	NSC	4901-03-9030	6
Q17 Q18 Q20 Q21 Q3 Q7 Q8	TRANS	2N3905	ITT	4901-03-9050	7
Q4	TRANS	TIP-29	TI	4902-00-0290	1
Q2	TRANS	TIP-30	TI	4902-00-0300	1
Q16 Q19	TRANS	MPS-2369	FAIR	4902-02-3690	2
	WAFER	147-400	WVTK	5104-02-0013	6
S	SWITCH STOP	215-33-001-01-22	CTS	5104-07-0003	3
SW1 SW2	DETENT MOD FROM 5104-01-0010	5104-99-0031	WVTK	5104-99-0031	2
SW3	DETENT MOD FROM 5104-01-0010	5104-99-0032	WVTK	5104-99-0032	1
	SWITCH, TOGGLE	7103 P3Y9AV2Q	C&K	5106-00-0019	1

WAVETEK PARTS LIST | TITLE: PCA, TRIGGER/PULSE | ASSEMBLY NO: 1100-00-0565 | REV: 0 | PAGE 6

NOTE UNLESS OTHERWISE SPECIFIED

REMOVE ALL BURRS AND BREAK SHARP EDGES | MATERIAL | F.N.SH WAVETEK PROCESS | DRAWN | DATE | PROJENGR | MFG ENGR APPROV | TOLERANCE UNLESS OTHERWISE SPECIFIED .XXX ± .010 ANGLES ± .XX ± .030 | DO NOT SCALE DWG | SCALE

WAVETEK SAN DIEGO, CALIFORNIA

TITLE: PARTS LIST PCA, TRIGGER/PULSE

MODEL NO: 145 | DWG NO: 1100-00-0565 | REV: 0 | CAGE CODE: 23338 | SHEET 1 OF 2

BISHOP GRAPHICS/ACCUPRESS RECORDER NO. A-3814

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REV	E.N.	BY	DATE	APP

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO	QTY/PT
SW4	SWITCH, TOGGLE	7108 P3Y9AV2B	C&K	5106-00-0020	1
NONE	WIRE, HU, 22GA	15U-BROWN	GAVTT	6000-32-2001	1
NONE	WIRE, HU, 22GA	15U-RED	GAVTT	6000-32-2002	2
NONE	WIRE, HU, 22GA	15U-ORANGE	GAVTT	6000-32-2003	2
NONE	WIRE, HU, 22GA	15U-YELLOW	GAVTT	6000-32-2004	2
NONE	WIRE, HU, 22GA	15U-GREEN	GAVTT	6000-32-2005	2
NONE	WIRE, HU, 22GA	15U-BLUE	GAVTT	6000-32-2006	2
NONE	WIRE, HU, 22GA	15U-VIOLET	GAVTT	6000-32-2007	2
NONE	WIRE, HU, 22GA	15U-GRAY	GAVTT	6000-32-2008	2
NONE	WIRE, HU, 22GA	15U-WHITE	GAVTT	6000-32-2009	2
NONE	WIRE, HU, 22GA	15U-WHITE/BLACK	GAVTT	6000-32-2090	2
NONE	WIRE, HU, 22GA	15U-WHITE/BROWN	GAVTT	6000-32-2091	2
NONE	WIRE, HU, 22GA	15U-WHITE/RED	GAVTT	6000-32-2092	2
NONE	WIRE, HU, 22GA	15U-WHITE/ORANGE	GAVTT	6000-32-2093	1
NONE	WIRE, HU, 22GA	15U-WHITE/YELLOW	GAVTT	6000-32-2094	1
NONE	WIRE, HU, 22GA	15U-WHITE/GREEN	GAVTT	6000-32-2095	1
NONE	WIRE, HU, 22GA	15U-WHITE/BLUE	GAVTT	6000-32-2096	1

WAVETEK PARTS LIST | TITLE: PCA, TRIGGER/PULSE | ASSEMBLY NO: 1100-00-0565 | REV: D | PAGE 7

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO	QTY/PT
NONE	WIRE, HU, 22GA	15U-WHITE/VIOLET	GAVTT	6000-32-2097	1
NONE	CABLE, COAX, 26AWG	RG 174/U	ITT	6001-40-0001	8
IC1	IC	MC1458P1	MOT	7000-14-3800	1
Q9	IC	7824	FAIR	7000-78-2400	1
Q12	IC	MC7905CP	MOT	7000-79-0500	1
Q10	IC	7924	FAIR	7000-79-2400	1
IC3	IC	7400	TI	8000-74-0000	1
IC6	IC	74L800	TI	8000-74-0010	1
IC3	IC	7407	TI	8000-74-0700	1
IC4	IC	74L808	TI	8000-74-0810	1
IC10 IC12	IC	74874	TI	8000-74-7401	2
IC2	IC	74LS74	TI	8000-74-7410	1
IC9	IC, TI 74L886 ONLY	74L886N	TI	8000-74-8611	1
B11	VOLTAGE REGULATOR	MA7805UC	FAIR	8000-78-0500	1
IC8	IC	MC10124P	MOT	8001-01-2400	1
IC11 IC13	IC	748132	TI	8007-41-3201	2
IC14 IC7	IC	748140	TI	8007-41-4001	2

WAVETEK PARTS LIST | TITLE: PCA, TRIGGER/PULSE | ASSEMBLY NO: 1100-00-0565 | REV: D | PAGE 8

REMOVE ALL BURRS AND BREAK SHARP EDGES | MATERIAL | FINISH WAVETEK PROCESS | DRAWN | DATE | PROTOTYPE | RELEASE APPROV | TOLERANCE UNLESS OTHERWISE SPECIFIED XXX ± .010 ANGLES ± 1 XX ± .02 | DO NOT SCALE DWG | SCALE

WAVETEK SAN DIEGO, CALIFORNIA

TITLE: PARTS LIST PCA, TRIGGER/PULSE

MODEL NO: 145 | DWG NO: 1100-00-0565 | REV: D | CODE IDENT: 23338 | SHEET 2 OF 2

NOTE: UNLESS OTHERWISE SPECIFIED

B-SHEP GRAPHICS/ACCUPRESS PO/ORDER NO. A 3867

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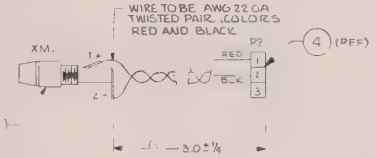
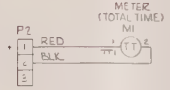
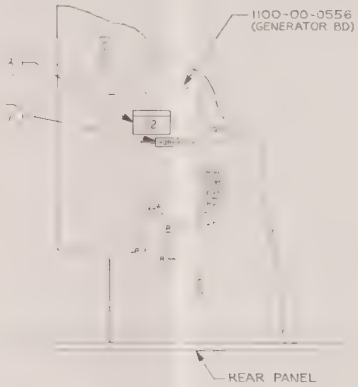


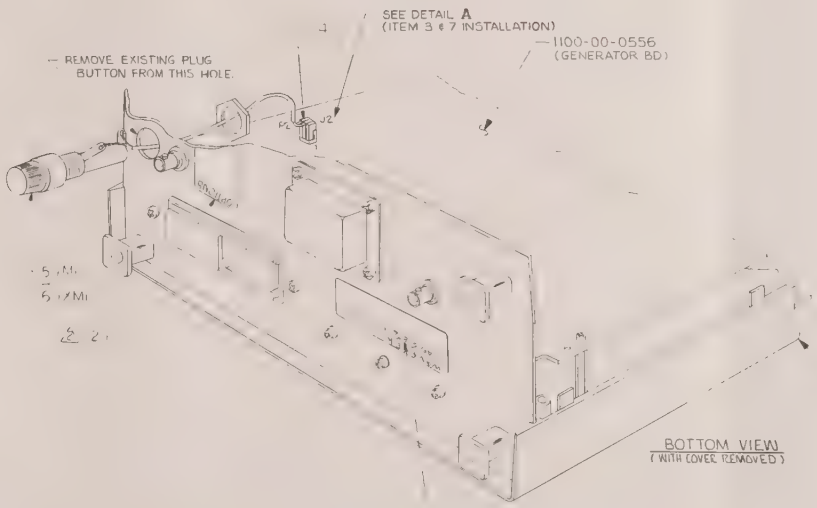
CABLE ASSEMBLY



SCHEMATIC



DETAIL A
SCALE 2:1



BOTTOM VIEW
(WITH COVER REMOVED)

MARK MODEL NO. "145-S-872"

⚠ MARK LABEL FOR OPTION 001

1 FOR PARTS LIST SEE 1000-00-0221

NOTE UNLESS OTHERWISE SPECIFIED

NEXT ASSY. USED ON / APPLICATION	DRAWN S. MAGNOLIA 7-5-8	QA	WAVETEK SAN DIEGO, CALIFORNIA
MATERIAL	PROTINGER		MODEL 145-001 OPTION 5000 HOUR TIMER
FINISH WAVETEK PROCESS	RELEASE APPROV	TOLERANCE UNLESS OTHERWISE SPECIFIED .XXX .010 ANGLES 1 .XX .030	
	DO NOT SCALE DWG	MODEL NO 145-001 145-S-872	DWG NO 0102-00-0221 REV
	SCALE	LATEST ISSUE 23338	SHEET OF 1

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REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
NONE	INSTALLATION DWG	0102-00-0221	WVTK	0102-00-0221	1
1	20MHZ PULSE/FUNCTION GENERATOR/145	145-STD	WVTK	1000-00-0101	1
2	LABEL OPTION	1400-01-4960	WVTK	1400-01-4960	1
3	CONN HEADER 3 PIN	640456-3	AMP	2100-02-0116	1
4	HEADER CONN 3 PIN	640440-3	AMP	2100-02-0117	1
5	INDICATOR, ELAPSED TIME(5000 HOUR)	T-000-A	FRED	2400-06-0006	1
6	HOLDER, TIMER	T-102	FRED	2400-06-0007	1
7	RES MF, 1/8W 1%, 2.15M	RN55D2154F	TRW	4701-03-2154	1

WAVETEK PARTS LIST

TITLE
MODEL 145-001 OPTION
5000 HOUR TIMER

ASSEMBLY NO.
1000-00-0221

PAGE 1

REV.

DESIGN CRITERIA AND/OR SPECIFICATION

MATERIAL

FINISH
WAVETEK PROCESS

DRAWN

DATE

ENGINEERING APPROVAL

TOLERANCE UNLESS OTHERWISE SPECIFIED
XXX ± .010 ANGLES 1
XX ± .030

DO NOT SCALE DWG.

WAVETEK SAN DIEGO, CA

TITLE
PARTS LIST
MODEL 145-001 OPTION
5000 HOUR TIMER

MODEL NO. 145

DWG NO. 1000-00-0221

REV.

FSCM NO. 23338

SHEET 1 OF 1

NOTE UNLESS OTHERWISE SPECIFIED

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PEGRIDS NO. 4-384

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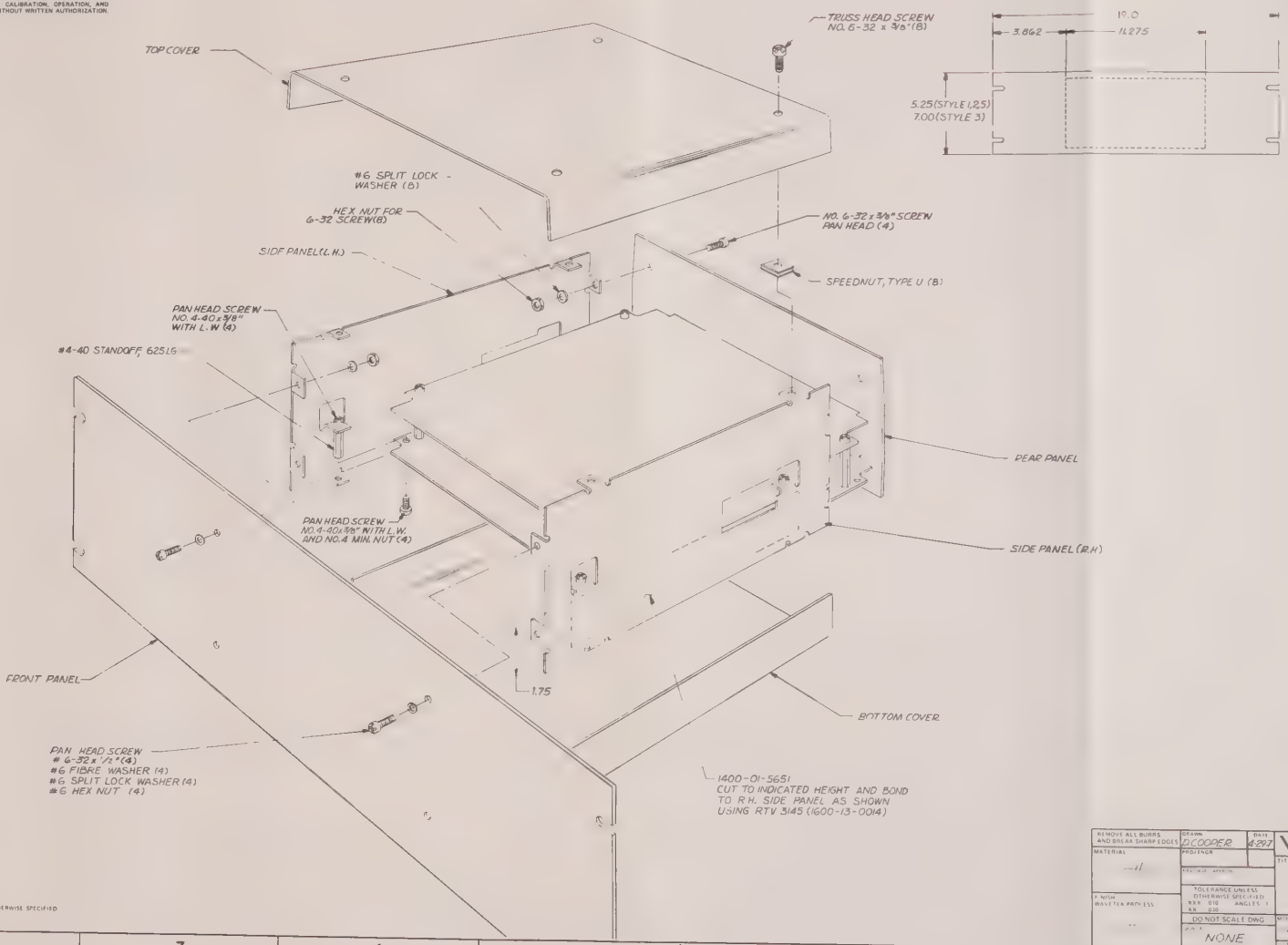
REV	ECN	BY	DATE	APP
A	4073	LC	4/1/85	
B	#4610	DAN	11-85	ACT.


TRUSS HEAD SCREW NO. 6-32 x 3/8" (8)
TOP COVER
#6 SPLIT LOCK WASHER (8)
HEX NUT FOR 6-32 SCREW (8)
NO. 6-32 x 3/8" SCREW PAN HEAD (4)
SIDE PANEL (L.H.)
SPEEDNUT, TYPE U (8)
PAN HEAD SCREW NO. 4-40 x 3/8" WITH L.W (4)
#4-40 STANDOFF, 625 LG
REAR PANEL
PAN HEAD SCREW NO. 4-40 x 3/8" WITH L.W. AND NO. 4 MIN. NUT (4)
SIDE PANEL (R.H.)
FRONT PANEL
1.75
BOTTOM COVER
PAN HEAD SCREW # 6-32 x 1/2" (4)
#6 FIBRE WASHER (4)
#6 SPLIT LOCK WASHER (4)
#6 HEX NUT (4)
1400-01-5651
CUT TO INDICATED HEIGHT AND BOND TO R.H. SIDE PANEL AS SHOWN USING RTV 3145 (1600-13-0014)

NOTE UNLESS OTHERWISE SPECIFIED

REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN P. COOPER	DATE 4-29-87
MATERIAL —	PROJ. ENGR.	
FINISH WAVETEK PROCESS	TOLERANCE UNLESS OTHERWISE SPECIFIED: .XXX ±.010 ANGLES ± .XX ±.030	
DO NOT SCALE DWG	APP'D NONE	

WAVETEK SAN DIEGO, CALIFORNIA

TITLE: ASSEMBLY RACK MOUNT

MFG'S NO. 43/1145 | DWG. NO. 0102-00-0621 | REV.

SIZE C | CAGE 23338 | SHEET 1 / 1

0102-00-0621

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REV	ECN	BY	DATE	APP

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
NONE	ASSY DRWG CHASSIS	0102-00-0621	WVTK	0102-00-0621	1
NONE	COVER, HALF, R/M	183-3412	WVTK	1400-00-3412	2
NONE	PL. SIDE, R/M, RH	183-3443	WVTK	1400-00-3443	1
NONE	PL. SIDE, R/M, LH	183-3633	WVTK	1400-00-3633	1
NONE	FRONT PANEL R/M	145-7600	WVTK	1400-00-7600	1
NONE	INSULATOR, R/M SIDE PANEL	1400-01-3651	WVTK	1400-01-3651	1
NONE	STANDOFF .625H, 250 HEX, 4-40	8833	SMITH	2800-02-0033	4
NONE	SPEEEDNUT, TYPE/U	C8091-632-4	TINN	2800-09-0004	8

WAVETEK PARTS LIST

TITLE
ASSY. RACK MOUNT
MODEL 145 (STYLE I)

ASSEMBLY NO
1101-00-0621

REV
C

PAGE 1

NOTE UNLESS OTHERWISE SPECIFIED

REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN	DATE	WAVETEK SAN DIEGO, CALIFORNIA
MATERIAL	PROTECTR		TITLE: PARTS LIST RACK MOUNT ASSY
	RELEASE APPVN.		
FINISH WAVETEK PROCESS	TOLERANCE UNLESS OTHERWISE SPECIFIED .XX ±.010 ANGLES ± .XXX ±.005		
	DO NOT SCALE DWG		MODEL NO. 145 | DWG. NO. 1101-00-0621 | REV. C
	QA		FSCM NO. 28336 | SHEET

Table 7-1. Hardware Part Numbers

The assembly drawings refer to hardware nomenclature. Use this table to get the hardware part numbers.

Nomenclature	Part Number
2-56 × 1/4 in. Panhead Screw	MS51957-3
4-40 × 1/4 in. Panhead Screw	MS51957-13
4-40 × 1/2 in. Pnahead Screw	MS51957-17
4-40 × 3/8 in. Panhead Screw	MS51957-15
4-40 × 7/8 in. Panhead Screw	MS51957-10
6-32 × 3/8 in. Panhead Screw	MS51957-28
6-32 × 1-1/2 in. Panhead Screw	MS51957-36
8-32 × 2 in. Panhead Screw	MS51957-53
6-32 × 3/8 in. Sheetmetal Screw	2800-22-6006
#4 Flat Washer	MS15795-803
#6 Flat Washer	MS15795-805
#4 Split Lockwasher	MS35338-40
#6 Split Lockwasher	MS35338-41
#4 Internal Tooth Washer	HH Smith 1127
#6 Internal Tooth Washer	HH Smith 1128
3/8 in. Internal Tooth Washer	HH Smith 1131
Solder Lug	MS77068-2
#2 (2-56) Nut	MS35649-224
#4 (4-40) Nut	MS35649-244
#6 (6-32) Nut	MS35649-264
3/8 in. Panel Nut	HH Smith 1199

ADDENDUM
FOR
INSTRUCTION MANUAL
MODELS 145 AND 145-S-872
MANUAL REVISION 10/83

Because of changes in part suppliers, certain capacitor values in your instrument may differ from those called out in the schematics and parts lists. These value variations are well within tolerable limits for correct circuit performance.

The following capacitor variations may occur in your instruments:

Assembly	Part	Ref Designation	Values
1100-00-0565	1500-35-0003	C-14, C-16	50 μF, 50V or 47 μF, 50V
1100-00-0565	1500-35-0103	C-6, C-8	500 μF, 50V or 470 μF, 50V
1100-00-0556	1500-72-7602	C-95, C-98	27 μF, 35V or 33 μF, 35V

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